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Induction Coils and Transformers.

A correspondent of the *English Mechanic* calls attention to a method of closing the magnetic circuit in induction coils through the medium of iron, which will be read with interest.

Fig 1 shows a diagrammatic view of the section of an ordinary induction coil, the dotted lines representing the paths which some of the magnetic lines of force may be supposed to take when the coil is in action. The effect then of the air space from *A* to *B* is to limit the number of lines of force, which for a given current can pass through core *E* to the low-carrying capacity of air, thus necessitating a number of turns and good current in the primary to produce but a feeble magnetism in the core, and from this feeble magnetism to produce currents of any tension a great number of turns in the secondary; if, however, by closing the circuit from *A* to *B* with a good conductor, the full number of lines of force are allowed to pass through *E*, the length of wire in the coil may be reduced to a minimum. This desirable result is partially attained in the Ziperknowski, Blathy, and Deri transformer, the primary and secondary being wound on an iron ring, which thus carries the lines of force due to the wires on the interior only of the ring From another inspection of Fig. 1 it may be seen that the circuit may be completely closed at all points by simply prolonging the core *E*, and bending the wires around the outside of the coil, in the actual path of the lines of force—a method of construction shown practically carried out in Fig. 2, and which thus becomes the reverse of Messrs. Ziperknowski, Blathy, and Deri's construction, the primary and secondary coils being wound on a wooden or ebonite bobbin, the terminals *A* and *B* being brought through, and carefully insulated; the whole is overwound with well varnished and annealed iron wire.

In induction coils for small currents, and as is indicated by the long existence of Rhumkorff's original form, length of wire is not of so much account as length of spark; but in its modern industrial application the "transformer," which is now beginning to be called upon to change the potential of very large currents, length of wire becomes a consideration, the resistance of the coils having an important bearing on the efficiency of the transformation.

Electric Lighting by Means of Low-Resistance Glow Lamps.

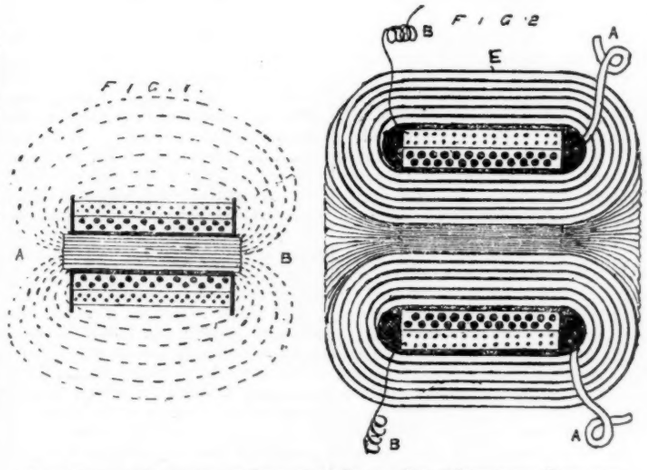
BY ALEXANDER BERNSTEIN.

It is not uncommon in the history of technical science to find that constructions which have at one time been abandoned on account of apparently unsurmountable difficulties have, after a certain lapse of time, been readopted. The high-speed engine, the high-pressure boiler, the multiple telegraph system, were known and made long before they were generally applied, because their practical application was impossible until a certain amount of experience had been obtained by means of the low-speed steam engine, the low-pressure boiler, and the single telegraph system.

In a very similar manner the low-resistance glow lamp was known and made more than thirty years ago, but has hitherto been considered impracticable. In the meantime the glow lamp of high resistance has made its way, and has met with considerable success.

Now, to-night, I desire to revive the older type of lamps in a new form, produced by means of our present experience, and to show at the same time the way in which these lamps may be made to answer the purpose of electric lighting.

As we have been so often told that the lamp of low resistance is neither practical nor economical, I must suppose that most electricians are somewhat prejudiced against it. But prejudices are detrimental to the development of truth, and I must therefore request you to take as impartial a view as possible of the case which I shall lay before you to-night.



TWO VIEWS OF SECTIONS OF INDUCTION COILS.—SEE "INDUCTION COILS AND TRANSFORMERS," PAGE 1.

High or low resistance of glow lamps is not merely a question of construction of the lamp itself; it is a question of principle which determines the whole system of lighting. The requirements of the dynamo, the sizes of the conductor, and the whole system of arranging the circuit, are entirely dependent upon the lamp which we select. It is, therefore, not sufficient to compare different types of lamps in regard to their qualities as lamps; it is quite as essential to consider how the use of these lamps answers the practical purpose of electric lighting. I shall therefore divide my paper into two parts—the first dealing with the lamp itself, the second with the manner of its application.

In speaking of glow lamps, and considering their merits, I shall only take such lamps into consideration in which carbon is brought to a state of incandescence, and admits light by reason of its elevated temperature. Although other substances may be used, experience has shown so far that none of them offer the advantages which are secured by the use of carbon, viz., the possibility of applying a very high degree of temperature. This is very essential, because the highest temperature implies the greatest efficiency; and efficiency, together with durability, are the two qualities which principally determine the merit of an incandescent lamp.

Before proceeding any further, allow me briefly to enumerate the principal parts which constitute an incandescent lamp These are only four—the glass bulb, the conducting wires (which always consist of platinum as far as they are surrounded by glass), the light-giving carbon, and the connection between the carbon and the wires (generally called the mounts). The simple construction of such a lamp does certainly not indicate that its manufacture is beset with so many difficulties. In order to settle our terminology, I shall further mention that the reciprocal of the number of watts required for every candle-power of light emitted will be called the "strain;" so that the strain is small if the number of watts per candle is comparatively large.

The light which is emitted by incandescent carbon depends only upon its temperature and the amount of its radiating surface; but the energy which is required to maintain this light would be determined—irrespective of the losses which may occur in the lamp, and under the supposition that the state of vacuum and the exterior temperature remain unaltered—by those same two magnitudes alone, if the radiating power of all carbon were alike. It seems to me that this last is not the case. From certain analogies, well known in physical science, we may conclude that a black, sooty carbon will radiate more heat than a carbon of a dense grayish surface raised to the same temperature, and consequently the former will require a larger supply of electric energy to maintain it at the same temperature than the latter. This fact seems entirely borne out by observations made on glow lamps.

Let us now consider the peculiarities of a glow lamp of high resistance, say of 100 volts and 0.6 ampere. I select this lamp because it seems that this is approximately the highest resistance lamp which can be practically applied at the present time. At least, I can see no reason why the complicated expedient of a multiple-wire system should be used, if electric lamps can be made reliable when working at a much higher difference of potential and with a corresponding smaller current. As the lamp is only to take 0.6 ampere, the filament must be exceedingly fine in order to become sufficiently heated by this current; and, moreover, the filament must be of sufficient length to obtain the necessary amount of light-giving surface. As soon as the current is passed through the filament, the latter is raised to a certain state of incandescence; and we shall therefore have to deal first of all with the effect which heat alone seems to have upon the carbon.

Heat has a general tendency to expand all substances; and as it was interesting to know how far carbon is subject to the same law, I have investigated this question. The experiment indicated that when the carbons were exposed to a strain of three watts per candle, the elongation of the filaments amounted to one 120th part of their length. It was further noticed that the rate of expansion was not constant, but increased with the temperature, although at the highest temperatures obtained the coefficient of expansion seemed to decrease again.

The fact that the carbon expands and contracts with every change of temperature explains why lamps with slender filaments are destroyed more quickly when subjected to varying currents than when they are fed by a constant and uniform current, such as that supplied from batteries.

When we look at a heated filament, we notice sometimes that one small spot is brighter than the rest of the filament. This is an indication of a flaw which will sooner or later produce the disintegration of the carbon at this particular spot. These flaws are, for the most part, so minute that they cannot be perceived in the filament when cold, and only gradually show themselves when the lamp is being used. This is one of the causes which produces premature destruction of the lamp. The finer the filament the greater the danger of a flaw.

It has lately been supposed by some writers on the subject that the life of a glow lamp is in direct proportion to the diameter of the filament. Such suppositions, which are mostly made for the sake of obtaining mathematical formulæ, are far too sweeping; and all we are entitled to say is that, *ceteris paribus*, the lamp with a black filament promises greater durability than the one with a thin filament.

We have before observed that heat produces expansion of the carbon, and from this we may infer that if the heat is sufficiently high evaporation or disintegration of the carbon would be the result. Such is the case if the carbon is of a soft quality and raised to a very high degree of temperature; but we are fortunately in a position to produce a carbon of such dense and hard structure that there seems to be no perceptible disintegration at the temperature usually employed in incandescent lamps. If we, nevertheless, observe in high-resistance lamps—even if worked at a strain of no more than four to five watts per candle, and a corresponding low temperature—that the carbon filaments are disintegrated, that the resistance of the lamps consequently increases, and that the glass bulbs begin to blacken, we are led to sup-

pose that other forces must be at work which produce the destruction of the lamp. These forces are of an electrical nature, and their existence is easily explained if we consider that an electric glow lamp is at the same time a vacuum tube.

In the high resistance lamp we have considered before, there is a difference of potential of 100 volts between the two terminals of this vacuum tube. The fact very soon makes itself apparent in the lamp. If the temperature is sufficiently high, the negative side of the carbon assumes a dark, sooty appearance, and a deposit of black, loose carbon is formed on the positive platinum and mount. This action of throwing off particles of carbon from the negative side towards the positive has been the subject of a very interesting paper communicated to the Royal Society by Mr. Preece. The peculiar behavior of high resistance filaments is evidently the effect of a combined action of heat and electricity. The heat lessens the attraction of the particles for each other, and the electric forces produce motion. The result is the gradual deterioration and ultimate destruction of the carbon.

It has often been noticed that a blue flame makes its appearance upon the positive platinum when the carbon is raised to a high state of incandescence. As no explanation of the production of this blue flame has as yet been given, I beg leave to insert here a few words respecting the most probable cause of it.

All platinum, when cold, occludes a large quantity of oxygen, which is given off again when the platinum becomes heated. The black, sooty deposit of carbon on the positive platinum is just in a condition to combine readily with the oxygen, and both together form the blue flame. While the lamp is on the vacuum pump this flame may often be seen to travel up and down the platinum wire, always appearing where occluded oxygen is set free. If the pumping continues without the current being increased, the quantity of free oxygen is soon consumed, and the blue flame disappears, but reappears again if the temperature of the platinum is increased by increasing the current. Just in the same manner finished lamps will, under all normal conditions, show no blue flame, but will do so if an excessive current is passed through the lamp. In this case a blue flame is sometimes seen on the negative platinum as well. This occurs because particles of carbon find their way to the negative platinum, and are oxidized there in the same manner. As the spectrum of the blue flame has been observed by Messrs. Liveing and Dewar to be that of carbonic oxide, it seems so much the more probable that the explanation here given is correct.

We have now to notice another effect of the vacuum tube. When lamps are made for very high difference of potential and corresponding small current, there seems to be a very strong tendency of the current to leap across from one terminal to another, thereby short-circuiting the lamp, destroying the filament, and fusing the platinum wires. This tendendency is very strong when the current is turned on suddenly, as the carbon, being cold, then offers the highest resistance to the passage of the current.

One of the conditions which it is desirable to observe in respect to a practicable lamp is that a certain excess of current, such as is liable to occur in installations, must not be able to destroy the lamp; and in this respect it is certain that the lamp with a thick filament is far superior to the lamp with a thin filament.

Turning to another point of practical importance, we notice that lamps with fine filaments are exceedingly subject to flickering as soon as the strength of the current varies but slightly. Variations of this kind may have their cause in irregular motive power, in slipping of a belt, or in a dynamo which is not perfectly balanced either mechanically or electrically. Such flickering will be noticed in a great many installations with small-current lamps, and is exceedingly disagreeable to the eye. Now, with a large hollow carbon used in the lamp which I shall presently describe, the interior is always at a higher temperature than the exterior, and serves as a reservoir of heat which allows for certain variations in the current, without any effect on the eyes as regards the light.

How are we, then, to obviate these difficulties appearing in the lamp? If the thin filament does not promise much durability, and is disadvantageous in other points mentioned—if the high difference of potential proves to be a factor in the destruction of the lamp—we must employ thick filaments and a small difference of potential; or, in other words, we must produce a low-resistance lamp.

I think I have sufficiently shown you the right of existence of a low-resistance glow lamp, and I shall now proceed by describing the lamp, the form of which seems to be one of the best of all the varieties of low-resistance lamps which I have made since 1882.

The lamp consists of a glass bulb of oval shape, into the opposite ends of which the platinum wires are sealed. In this manner the glass is placed symmetrically round each wire, and is therefore less liable to crack when heated. The carbon has the form of a straight tube mounted upon short pieces of stout platinum, which are joined to the platinum wires passing through the glass by means of flat thin copper strips, bent upon themselves so as to form springs at right angles to the direction of the carbon. In this way all parts of the lamp can expand and contract without subjecting the carbon to any injurious strain. A cap of insulating material at each end of the glass bulb provides for proper connection with the conducting wires, which may be made to support the lamp; and this connection is made in such a manner as to prevent accidental contact of the manipulator with any part carrying a current.

The success of these lamps depends on the satisfactory construction of every one of its details in an almost equal degree. The quality of the carbon, the way in which the same is mounted, the manner of surrounding the platinum wires with the proper kind of glass, the avoidance of any mechanical strain, and the proper proportion of every part of the lamp, are all the results of tedious experiments, which were necessary in order to produce a satisfactory lamp. The electrical dimensions of the lamp are as follows: It requires a current of 9.75 amperes, thereby showing a difference of potential of 7 volts, and a hot resistance of about 0.7 ohm.—(20 candle-power.—Ed.)

When speaking of the high-resistance lamp, I have mentioned that there seems to be a limit to the difference of potential which we can apply in each bulb. As regards the low-resistance lamp, there is a limit to the strength of the current of which we can avail ourselves. The difficulty rests with the wires, which have to be sealed air-tight into the glass, as it is far easier to seal in thin than thick wires carrying a large current.

Before concluding this first part of my paper, I shall have to mention one of the drawbacks of the low-resistance lamps, to which Prof. Forbes has called attention in his excellent lectures on the distribution of electricity, viz., the loss of heat in the conductors inside the lamps. I quite agree with Prof. Forbes that in older types of lamps the loss was very considerable, and a serious question; but in the lamps which I made some years ago this loss amounted to only one-tenth part of the energy consumed. I am happy to inform you that in the lamp before you this loss has been reduced to one-twentieth part of the energy required in the lamp.

I shall now turn to the second part of my paper, and I shall consider it best to attack at once the most difficult problem which can present itself, viz, the supply of a large number of lamps from one central station, with the condition that all the lamps can be used entirely independent of each other, and with the further condition that the expenditure of mechanical energy shall always be proportioned, or, at all events, approximately proportioned, to the number of lights in use. Our imaginary plant is to be arranged for 6,000 lamps, requiring 9.75 amperes, and upon the average 6 volts each. Let us first look into the central station and consider its requirements. We shall settle upon the use of a dynamo which with a current of 10 amperes is capable of producing an E.M.F. of 2,000 volts—a kind of dynamo which was first applied by Mr. Brush, and which is already extensively used for arc lighting, or for a combination of arc lights with groups of glow lamps, several of the latter being always arranged in parallel. But the lamps of which I spoke at greater length in the first part of my paper are made for the passage of the whole current, and will therefore be arranged in series, one being placed in the line after the other. In this case there will be more than 300 lamps on each line; let us say 300. We shall therefore require 20 such dynamos, and one or two spare machines in case of repairs. These 20 dynamos may be driven from shafting, or each by a separate steam engine. There are 20 separate lines proceeding from the central station, and as the main condition of our system is that the current on every line must always be kept constant, we must provide for the regulation of each dynamo in such a manner that the E.M.F. always corresponds to the number of lamps which are in use. This regulation can be effected by automatic devices, or may be done by hand in adjusting the magnetic field or the speed of the dynamo. An ampere-meter which is placed in every circuit will indicate whether this condition is fulfilled, and a voltmeter connected with the terminals of each circuit will inform us how many lamps are used on each line at any time. A registering voltmeter placed in the same manner would be another useful addition. The central station, furthermore, contains a switch-board, which allows any one of the circuits to be connected with any one of the dynamos. If we presume that the station is to supply current day and night, it would certainly be absurd to run all the dynamos constantly at those times, when only a small number of lights are required. At daytime, then, I should propose to loop several circuits together, and if the total number of lamps is sufficiently low, all the 20 circuits might be looped in a single one, so that only one dynamo need be kept running. By means of an auxiliary line of lamps in the central station, dynamos and circuit may be switched in and out without any sudden change in the conditions of either. The system of working would then be that in the afternoon one dynamo after the other is switched into its respective circuit, the requirements of which can always be ascertained on the voltmeter of this circuit. If the consumption of light decreases, the dynamos are gradually switched out again. By the addition of an arrangement for observing and measuring the state of insulation of every line, the outfit of the central station might be considered complete. I have not mentioned any apparatus in connection with the central station which could not be easily constructed with the means at our disposal at the present time.

We now leave the central station, and turn our attention to the conductors. These are 20 pairs of copper wires of small size, say No. 6, well insulated. Experience has shown, so far, that there seems to be no great difficulty in insulating a wire if the tension of the current is not more than 2,000 volts. If we suppose that the central station is in Pimlico, on the banks of the Thames, a few wires may be laid in the direction of Victoria Station, a few more may reach the Houses of Parliament, some may be laid in the direction of South Kensington Museum, and some others may be used for lighting private houses—in each of which I shall suppose that, upon an average, 20 lights are used at the same time. In this case 15 houses are passed by the same conductor, which supplies current for 300 lamps. All these lights can be turned on or off at will, quite independent of each other, because we have provided in the central station that each dynamo is regulated in such a way as always to produce the same strength of current, no matter whether there are 300 lamps alight in each conductor, or only 10.

Let us now compare this system with the only other system in which glow lamps are arranged quite independent of each other, leaving out the consideration of secondary generators. In the parallel system the central station must be in the center of the district to be lighted, which is often very objectionable, and sometimes impossible. In the series system the station may be far out of the way. In the parallel system we are restricted to use of a 100-volt lamp, as we have seen before, and, in consequence, the radius of the district to be lighted must be kept very small, or the expenditure for conductors would be prohibitive. In the series system the expense for conductors is comparatively small, and we may reach any distance. The parallel system requires that a fixed difference of potential should be maintained in all the conductors under varying strength of current—a condition with which it is even theoretically impossible to comply, and which entails enormous practical difficulties. In the series system we have to maintain a constant current under varying resistance—a condition which can be easily fulfilled. When the parallel system was first developed, the prevailing idea appears to have been to make electric lighting from central stations similar to gas lighting. But the conditions under which electrical energy in its active form is best transmitted are so different from those requisite for the transmission of the potential energy of gas, that the desire to imitate the gas system has proved rather a disadvantage.

We now arrive at the last, and perhaps the most difficult, part of the whole installation viz., the outfit of the place which is to be provided with lamps. For the sake of simplicity, I will suppose the place to consist of one single room.

The street main enters the house at the main switch, drawn larger than the others; it continues from switch to switch, and returns to the main switch before leaving the house. We have supposed the street mains to be composed of No. 6 copper wire, but the house mains may be made equal in section to No. 10 wire, in order to be more flexible. The lamps are always connected to their respective switches.

From what has been said before, it is quite evident that the first and essential condition of such a system must be that the circuit is never to be opened, whatever may happen. As we are always dealing with a closed circuit, it will prevent misunderstanding if we give a different designation to the two ways in which the circuit can be completed; and I shall therefore call the circuit "short-closed" if the current goes directly through the switch-lever, and "long-closed" if the current is led through the lamps or other electric devices, such as motors, which are to be acted upon. The fact that the circuit is never to be opened reduces one great difficulty in the switch required in the parallel system, viz., the liability to produce an arc.

The main house switch, to which I shall now invite your attention, serves the purpose of either short-closing the street circuit, so that no current can pass into the house, or of long-closing the same, thus including the house circuit into the main circuit. In the first case, I have not considered it sufficient merely to prevent the current from entering into the house; I have thought it advisable to disconnect the house circuit entirely from the street circuit at the same operation, so that any alteration of the circuit may be made inside the house without the possibility of a branch current being established, even if the street circuit should be of defective insulation. But this switch is also made to another purpose. Supposing that the street circuit, which has been short-closed, is now to be long-closed, but that by some accident or another a break of the continuity of the line has occurred in the meantime inside the house; if now the switch-lever were to be moved with the intention of allowing the current to enter the house, the result would be the formation of a long arc, and eventually the whole current would be interrupted.

(Mr. B. here described his safety switch by letters.—Ed.)

If it were now intended to allow the cur-

rent to pass into the house circuit, the lever *L* would have to be turned from position 1 to position 3; but when lever passes over the intermediate position, 2, it first connects the metal piece *D* with *E*. But the metal piece *D* is permanently connected with *C* by means of the resistance R, and the main current will therefore be divided in two parts—one, the greater portion, passing through *R* and *L* to *E*; the other, the smaller portion, passing through the house circuit in case the same is complete. This house circuit includes the electro-magnet *K*, which is situated inside the switch, and the armature of this electro-magnet carries a pin *P*, which is in such a position that it is below the plane of the motion of the lever *L* if the armature be attracted, but hinders this motion if the armature be not attracted. In case, then, that the house circuit is complete, there will be no impediment to the further motion of the lever *L* from position 2. It will therefore reach position 3, where it rests upon pieces of insulating material, and the whole current now passes through the house circuit. But if the house circuit had not been completed, the motion of the lever would have been arrested by means of the pin *P*, and a break in the circuit is in this way made a matter of impossibility.

The lamp switch is practically a mere repetition of the main switch on a smaller scale. But the lamp switch contains an additional arrangement, which would be a useful adjunct to the main switch as well, viz., the automatic cut-out. This is intended to act if the lamp should fail during the passage of the current, in which case the break of the circuit is prevented by short-closing it around the lamp. The arrangements which I have used to provide for this eventuality are of two kinds, and may shortly described without reference to any drawing. Both are based on the principle that if the resistance of the lamp increases—which always occurs in lamps placed in series when the carbon gives out and an arc is formed—then a current in a shunt around the lamp will increase. In one of these arrangements this increased current is made to act upon the armature of an electro-magnet, which armature releases a spring for the purpose of making a direct secure contact between two places of the circuit in which the lamp is situated, and a short circuit is thereby formed round the lamp. In the other arrangement a fusible wire is placed in the shunt, and a lever is arranged in such a way as to be acted upon in one direction by the wire, and in the other by a strong spring. If the wire fuses, the spring presses the lever against contact pieces, which serve the same purpose as specified above. In neither case can the circuit, which is now short closed, be made to include the lamp again until the cut-out lever has been moved into its former position by hand. The combination between the switch and the cut-out lever is such that the switch-lever has to be placed into position 1 before the cut-out lever can be operated upon by hand. The reason for the adoption of this last arrangement will become evident by a consideration of the peculiarities of the switch which I have mentioned before. I believe that in this way I have provided for the prevention of a break in the circuit which may occur from any eventuality.

I need not dwell on the construction of the lamp-holder, the only part of the outfit which has not yet been mentioned. It may be made in different ways, but one principal idea has been adhered to in its design, as well as in that of all other details which constitute the outfit of a house; there is no part conveying a current which is not perfectly insulated, or which is in any way exposed so as to offer the possibility of any person coming into contact with it. This is hardly possible in arc light circuits, but may easily be done where only glow lamps are used.

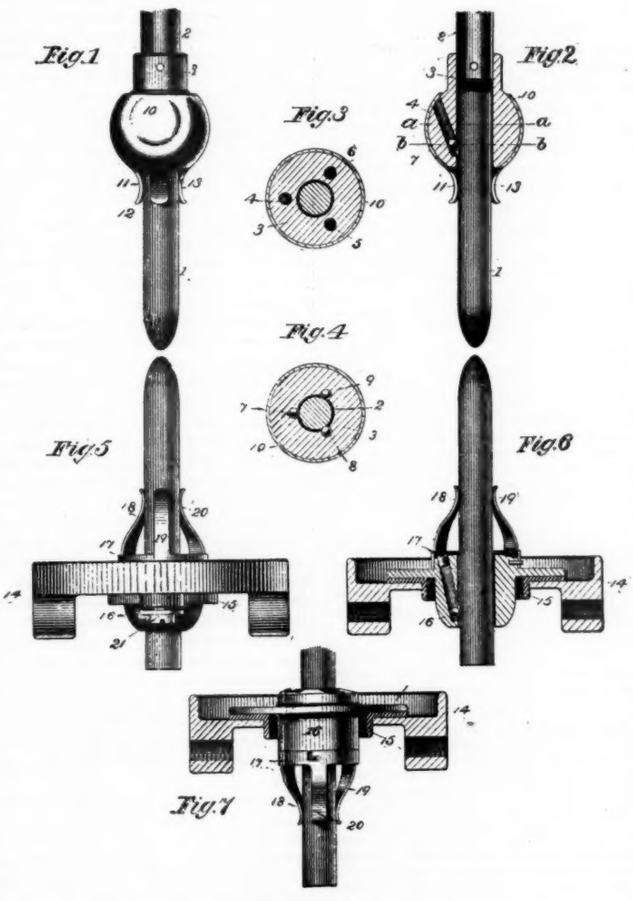
And this brings me to the last question which I shall have to consider, namely, the question of safety. Here again I shall have to note one very great advantage of the series system over the parallel system, and this is the impossibility of a wire becoming overheated. Every experienced electrician knows as a fact that short circuits in the parallel system have often led to detrimental results in spite of safety fuses; and a system in which such a danger does not exist, and which consequently does not require any provisions against it, has certainly much to recommend it. Especially in such cases in which the danger of fire must be most dreaded—in ship lighting—I believe that this advantage of the series system will be very greatly appreciated.

I now come to the objection generally raised against the use of high-tension currents. If an inventor were to appear to-day saying he wanted to introduce into our house a substance which, when properly used, was intended to give light, but which in itself was a poison, and produced poisons when used as a light, and of which it was further known that it was always ready to form an explosive agent when mixed with atmospheric air, I believe that the critical spirit of our time would raise an outcry against the introducton of such a dangerous substance, and against the use of the public streets for its conveyance. But this substance—of which we know that it is quite harmless as long as it is retained within metal tubes—is now actually carried into all our houses, and we are so familiar with its peculiarities that no one feels any nervousness nowadays in the neighborhood of a gas chandelier.

In conveying a high tension current into a house we are in a far more favorable position than if dealing with gas, because the probability of an accident is far more remote. Three conditions must be fulfilled before any person can be injured by an electric current. First, there must be a certain amount of leakage on the line; secondly, the person must be in contact with a bare conductor; and, thirdly, the person must at the same time be in contact with the ground.

In the system of central lighting which I have laid before you it is easy enough to constantly ascertain the condition of the line, and far easier to locate a fault than in a complicated system of branch wires. It is, further, easy to construct all parts of the system inside a house in such a manner that contact with a bare conductor is impossible; and, moreover, a person standing on a carpet and a dry wooden floor is exceedingly well insulated. The tension which we can use with safety depends simply upon our means of insulation If you will recall the precautions which have been taken in the construction of the switches by entirely disconnecting parts of the circuit from the main circuit, when lamps have to be replaced or alterations to be made in the circuit, then I think you will agree with me that the probability of an accident is exceedingly remote; and this system of lighting appears to offer more safety than any other method of artificial lighting at present in use.

And now, in conclusion, I should like to say that in a short paper like this which I have had the honor of reading to you, I found it impossible to enter more fully into details than I have done, and I have therefore restricted myself to the explanation of those details and the discussion of those questions which appear to me of prominent importance. I hope that by my humble efforts I may have accomplished the object of my labors, namely, the further extension of the field of electric lighting.



ILLUSTRATIONS OF THE STUPAKOFF CARBON HOLDER.

The Stupakoff Carbon Holder.

Generally but little attention is paid to the furniture of arc lamps, and yet the success of the whole of a system of electric lighting depends greatly upon it.

Those parts situated outside of a lamp, which are most handled and usually served by unskilled men, should be simple, solid and durable.

Particular excellence in this direction is claimed for the carbon holder which was recently patented by Simon H. Stupakoff, of Hartford, Conn. (now in Rochester, Pa.), and of which we are giving, this week, an illustration. The clamping or holding of the carbons is effected by three small balls (7, 8 and 9) sliding freely in cylindrical holes (4, 5 and 6), which are drilled in their respective supporters (3 and 16), in an inclined direction to the centerline of the carbon. These converging recesses all open into the central recess, which is destined for the reception of the carbon; but these openings are of an egg-shaped form, of which the upper half has about the diameter of the balls. This effects that these balls must protrude into the central recess, though they cannot pass through the openings altogether. The egg-shaped opening is obtained simply by observing that by drilling the inclined channels the drill does not run much farther into the central recess until its point protrudes into the same.

The balls are made of a very hard material, either hardened steel, phosphor-bronze or bell metal. They are nicely finished, put into their channels; these are somehow plugged up, and the carbon holder is finished. Sometimes there are but three balls in one plane; sometimes three more in another plane, and sometimes three or more in different planes used, just at the desire of the constructor. Three of them will answer very well for the purpose, when there is used beside a kind of a crown (10 and 17), with three extensions, 11, 12, 13, and 18, 19, and 20 to it.

The carbons are inserted into these holders from below in an upward direction, solely by pushing them into the position required. The balls act now as wedges upon the encircled carbons by their own gravity, and prevent their direct withdrawal, while they permit their withdrawal spirally. A single motion of the hand holding the carbon will therefore fix it firmly in the carbon holder, and a compound pulling and turning motion will readily withdraw it therefrom.

Top and bottom carbon holder are both constructed after the same principle. The only difference is, that one of them, as shown in Figs. 1–4, is provided with ball and socket joint. The shell 10 incloses the spherical part of the carbon holder 3, and its downward projections 11, 12, and 13 are in direct contact with the carbons. The spaces which divide the projections 11, 12, and 13 are continued upward to the equator of the spherical part of the carbon holder (not shown in the cuts), so as to be removable therefrom by turning the shell upon the carbon holder till those projections reach alignment with corresponding grooves contained in the outer surface of the carbon holder, to admit the upward passage of those projections without much bending them.

The Figs. 5, 6, and 7, show a carbon holder in connection with a globe supporter. The ring 17, with its projections 18, 19, and 20, is fixed with a bayonet-joint to the holder, as shown in Fig, 7. This serves merely for the purpose of effecting a more solid contact with the carbons, while it is at the same time a protector for the carbon holder, if, in case of neglect, the carbons should burn too low down. It will prevent, therefore, the damage to the holder itself. (Mr. Stupakoff has another device which prevents the burning out of carbon holders, as it switches the lamp off at the proper time before this could happen.)

If it should happen to be necessary to exchange the lower carbon for a new one, this may be done even while the lamp is in circuit, without lowering it down from its elevated position, by putting the carbon into the tubular extension of a stick and pushing upwards with it the short piece of carbon which was still left in the carbon holder, which will cause it to drop into the bottom of the glass globe, while the new one has taken its place already.

These carbon holders will hold carbons of different sizes; by using balls of $\frac{5}{16}$ of an inch in diameter they may vary $\frac{1}{8}$ of an inch, and by using those of $\frac{1}{4}$ of an inch they may vary $\frac{3}{16}$ of an inch, say from $\frac{7}{16}$ to $\frac{5}{16}$ of an inch.

They will hold as well carbons with a smooth as with a rough surface, and unevenness or inequalities on their surface does not interfere with their good working.

Any one who wishes to convince himself by experiment of the simplicity and handiness of this device, may take a piece of thick brass tubing, about $\frac{5}{16}$ inside diameter, drill from one of its ends in the rounding of it, three holes in an inclined direction, and drop these steel balls into the same as frequently are used for the bearings of bicycles. He will have a model good enough to tell about its solidity, durability, and cheapness.

Electrical Review.

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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NEW YORK, JULY 3, 1886

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India rubber is menaced with a rival. The rubber dealers of East Nicaragua think they have discovered a tree whose gum will give as much satisfaction as rubber, and will, in fact, take its place. They say that the milk of the tuno furnishes a most excellent gutta-percha, equal to the best found in the Eastern tropics, while the number of trees is virtually inexhaustible, and the gum can be produced with profit at 12 cents per pound.

The Nebraska Telephone Company has completed a line from Nebraska City to Lincoln, 60 miles, using hard drawn copper wire, No. 12 standard gauge, with carbonized paper insulators. There are six intermediate offices. The line works first-class. The company uses it direct to Omaha. Total distance, 131 miles, 71 of this being iron wire of No. 10 gauge, and nine offices being intermediate. This we should call pretty good work. Business in Omaha, where the company's headquarters are, is booming. They do not solicit in any shape, yet are putting in about 25 subscribers per month.

The REVIEW is not throwing sops to electrical interests for patronage or for anything else. A journal that has not the courage of its editor's convictions can never deserve the confidence of its readers. Electrical science, notwithstanding the numerous selfish schemers that are endeavoring to build upon it, is continually advancing, and its field widening, and to this great end is the REVIEW devoting its best energies and most zealous and careful efforts.

The people of this broad land are now awakening to the value of the telephone, judging from the increase in subscribers that is reported by the leading companies. This revival of the demand for these instruments in times that are not such as to induce business men to enter into any unnecessary expense, indicates one thing, namely, that the telephone is nowhere regarded as a luxury, as it once was, but is now recognized as a time-saving and valuable essential to the transaction of business. And this is what pleases the telephone companies.

An unusually interesting paper on the early history of telegraphing sound, by Prof. Pickering, of Harvard College, appears in this issue of the REVIEW. We do not remember ever to have seen in one grouping so many important statements, in this connection, as Prof. Pickering here presents, making his production a valuable addition to the history of the telephone, and the early experiments that finally led to Prof. Bell's wonderful achievement.

At Paris, Ill., by a large majority vote at the April election, the City Council was instructed to contract for electric lights instead of gas for lighting the streets. At a subsequent meeting of the council $10,000 were appropriated, and special board created to carry out the instructions of the people. Contracts for buildings and plant have since been made. Notwithstanding this, however, the Mayor and Council and City Treasurer were enjoined, June 25, by Judge Welken, from building the electric light plant and from increasing the city's indebtedness in any way whatever. The contract having been made before the injunction was served, the situation becomes interesting. When the case is heard, the injunction will probably be dissolved.

As announced elsewhere, the Forest City Carbon Manufacturing Company is now thoroughly equipped with new apparatus for manufacturing that somewhat uncertain quantity, an arc light carbon. It may not be generally known that Col. H. C. Adams, of the firm of Holmes, Booth & Haydens, owns a controlling interest in this carbon company, and is vice-president and general manager, and its success is due to his efforts.

Arrangements were completed at the meeting of the Executive Committee of the National Electric Light Association, held in this city last Tuesday, which assure an interesting and comprehensive programme for the August convention. All information indicated an increased interest in the work of the association, and would seem to assure the largest attendance at Detroit of any meeting of the electric light representatives. The REVIEW urges all those interested in this application of electricity, who have not done so, to at once unite with this association. The valuable work it is doing and is contemplating can hardly be over-estimated.

In the detail of the meeting of the Executive Committee, there were read a number of communications from the chairmen of the various committees and others, indicating that the topics that would be presented to the convention, at Detroit, would be comprehensive and timely, and of a nature that would make them particularly valuable to the electrical interests represented by the convention. An interesting report from Mr. Arthur Stewart, of Baltimore, chairman of the Legal Committee, which outlined the work of this committee, was read, and made a special order for the Executive Committee at its next meeting. Dr. Otto Moses, of New York, chairman of the Electrical Bureau Committee, submitted an outline report, recommending the appointment of a chief statistician, with headquarters in New York, to whom all members of the association could apply for information; the chief, or statistician, to receive a salary for his work; a fee, to cover extra expense, to be charged where special expert information is requested. The report will be presented in full at the Detroit meeting. It was decided that another meeting of the Executive Committee be held in Detroit on August 30th, the day preceding the meeting of the association.

STORAGE BATTERIES.

Like a Phœnix from the ashes the storage battery has again arisen, shaken off the lethargy of its five years sleep, and, bobbing up serenely, is now prepared to astonish the world. We hear all sorts of stories on this and from the other side of the water of the probabilities, not to say possibilities, of the future battery, and we are glad of it. We always had a hankering in the direction of storage batteries and we are more than pleased to announce that there is a very fair prospect of a commercially practical battery being soon put upon the market by commercially practical men. We mean just that, a battery that is good for two or three years at least without repair, and which will give a commercial not a fancy laboratory efficiency of at least 85 per cent. We have had the pleasure within the last week of inspecting a plant of 20 cells which have been in actual use for over a year, charged and discharged daily, and which have not cost a cent for repairs and which we are creditably informed show not the least sign of deterioration. Such a battery will be a positive boon to electricians, and we have no doubt that its introduction will stimulate largely the demand for incandescent lighting plants, not to speak of its use with motor and kindred apparatus. We sincerely hope our expectation will be realized, and that the storage battery has come to stay.

LOW VS. HIGH-RESISTANCE GLOW LAMPS.

We publish in this issue a portion of Mr. Alexander Bernstein's paper on Low-Resistance Glow Lamps, recently read by him before the English Society of Telegraphic Engineers and Electricians. We commend the paper to the attention of our readers, not so much because it contains anything radically new, as for the reason that even old facts, when well stated, are worthy of attention. We wish to remark here, by way of parenthesis, that it is a most unfortunate fact that many of the most conscientious workers in the domain of science are utterly incapable of lucidly describing their work and the results, or consider it necessary to clothe their thoughts in language utterly incomprehensible to the average reader. Big words, high-sounding phrases and obscure mathematical formula are too often employed to explain (?) the simplest facts. We never could quite comprehend the object, unless it be to have the paper look learned. It's a very bad practice, and we would advise all who would write to impart information to use as few and as simple words as may be necessary to explain their thoughts. Such text writers as have adopted this plan find their works the most widely read and most deservedly popular.

In regard to the subject of Mr. Bernstein's paper, *i. e.*, the superiority of low over high-resistance lamps, briefly, we don't agree with him; we do not believe that a current of 2,000 volts E.M.F. can be safely carried through private dwellings—at least, not yet. People are too apt to meddle with the fixtures, and such a current is without doubt dangerous, even under the best conditions of work of the generating machine.

Again, with a circuit such as he describes—300 lamps, distributed in series through a number of dwellings—the risk is too great; any accident to a fixture or main, such as is liable to occur, would extinguish all the lamps at once, which would be very disagreeable, to say the least.

The saving in the cost of conductors is, no doubt, very considerable, but we see no particular advantage in the lamps themselves, as it is yet to be proved that the life of such a lamp materially exceeds the now commonly accepted duration of a well-made, high resistance lamp—that is, from 1,500 to 2,000 hours.

Looking at it from all the different standpoints, we do not see that the system proposed by Mr. Bernstein possesses any particularly meritorious feature—not sufficient, at any rate, to warrant a change from high to low resistance lamps. We do not deny that the time may come when such a system will be found commercially advisable, but that time has not yet arrived.

ELECTRICAL NEWS OF THE WEST.

What an army of ghouls there is distributed through the domain of science, to be sure. Prof. Lodge, of Liverpool, recently astonished the world of savants by his experiments in the condensation of fumes by means of electrical current. Now W. M. Hutchings comes to the front with a communication signed C. F. Guitard, published in the *Mechanic's Magazine* in 1850, over a third of a century ago, which seriously disgruntles the Professor's priority claims: Mr. Guitard says:

"Sometime since in experimentalizing on the electric state of the atmosphere, I employed for that purpose a large glass cylinder, about 18 inches high and 9 inches in diameter, open at bottom and having a neck at top. In placing the lower end of this cylinder in water the more perfectly to exclude the air, and allowing small quantities of tobacco smoke to enter the neck at top, the smoke, after assuming various actions, according to, probably, the hygrometric state of the atmosphere, would gradually spread itself into a cloud filling the cylinder, and, at length, as successive portions came in contact with the sides of the cylinder, condense. Sometimes half an hour would elapse before this effect took place. It now struck me that if I brought a wire from an electrifying machine into the neck of the cylinder, the air would immediately become charged with electricity, which would cause each portion of the smoke to fly to the sides of the cylinder, and that thus more rapid condensation would take place. The effect produced was perfectly magical. The slightest turn of a small electrifying machine produced immediate condensation. It was astonishing to see how small a quantity of electricity produced a most powerful effect. I am not aware that attention has ever been drawn to this subject, and the question will probably arise: Has electricity anything to do with the condensation of steam in the condenser?"

At Rockford, Ill., on the 20th, a $4,000 fire in a furnishing goods store was caused by an electric light wire.

On the same date a fierce hail storm, with the usual accompaniments of flashes and rolls from heaven's artillery, swept over the whole northern portion of Minnesota, and portions of Wisconsin were pelted with hail stones as big as hen's eggs, according to an Eau Claire correspondent. Some hens eggs are not as large as hail stones.

An item in the Shanghai (China) *Courier*, says that a gentleman there has invented an electric sword, which, when the point touches the party attacked, sends a powerful shock through him, and either kills or knocks him out of time instantly.

The chap who wrote the account talks about a powerful storage battery, the size of a cartridge box, strapped to the waist. Insulated wires connecting the battery with the sword—an ordinary military sabre—along the blade of which a fine platinum wire is let in, which ends at the foil of the weapon. "By pressing a push button the holder can complete the circuit at pleasure."

How wonderfully ingenious, simple, and complete—rendered so practical by the omnipresent push button. Your electrical inventor is like an amateur prize fighter who strikes below the belt. He always wins by punching the push button.

The Pan Electric seems to be one of those institutions which is suffering from a sort of intestinal war in the shape of legal pangs and pains. The inventor wants his money, and says to the defendants in the suit he has brought against the honorable gentlemen, recent partners of the learned expert, Messrs. Garland, Harris, Johnston, Atkins, and Young, that he is entitled to $100,000 damages through their failure to perform their contract. He makes this mild remark also:

"I do not intend to be left as the inventor to 'hold the bag' while you run off with the

great bulk of the money—some $40,000 in cash and about $3,000,000 in good local stock—to shelter yourself under the throne of the National Administration."

It is one of the rules of the game of "snipe driving," that when you are tired holding the bag you don't have to wait for the snipe any longer.

Laramie, Wyoming, has its first incandescent plant of the central variety. About 1,500 incandescent lights were put in service on the 12th of June. The plant is a very neat and substantial one, and the engine used is an Ide. Mr. Bates, the electrician in charge, tells a story of a couple of strangers who, after having inspected the plant, left the station engaged in a animated discussion. By and by they returned, and one of them, considerably excited, said to Mr. B. "Mister, we have had an awful hot debate, and we want you to settle it for us. Now, I claim that the electric light is made from friction with sand, and he claims that it is made from brass."

Mr. Bate's decision as umpire of course declared all bets off, and harmonized the discord.

Indiana matters are quietly moving along, and the manly course pursued by the Central Union Telephone Company's officers under their discouragements is winning hosts of friends for the management. The people begin to think they have been used to pull chestnuts out of the fire for some one else's benefit, and are loud in their denunciations of the unwise—if not criminal—legislation which has placed them in their present dilemma.

The municipal authorities of Indianapolis, on the petition of the Central Union, endorsed by the citizens, rescinded the ordinance requiring the removal of the company's poles and lines, and granted it permission to furnish service temporarily, until a new organization should be ready to pick up the dropped stitch, and continue the knitting. It was expected that the Wallace people, who had 30 days in which to make a beginning, might be ready. That thirty days expired on the 24th and, unless further concessions are granted by the municipal fathers, the Wallace chances have ceased to exist by limitation.

In the mean time two causes have been at work which have as effectually dampened the ardor of the agitators as ever a Chinaman dampened his washee-washee by blowing water over it.

The New Orleans decision made the fact patent to all—so plain that he who runs may read—that, despite the inventions of the enemy, the taking of the wrestling match far away from the ground of former decisions and judges who had formerly set on similar cases as possible, and all the other little tricks of the trade—that there is very little hope of any system outside of the Bell being permitted to operate in Indianapolis or any where in the United States after the courts get through the present suit.

The toll system has been inaugurated in Indianapolis, and the people who use telephones are well satisfied with it. About 500 telephone lines were, it will be remembered, discontinued at the end of the first quarter of 1886, and it was expected that on the first of July the remainder of the subscribers would be closed out, and the Central Union would withdraw from the city.

A contrary current has set in, and many, who were discontinued as above, have had their instruments replaced, and are working, satisfied and comfortable, under the toll system. In order to as perfectly adjust the matter of charges as possible, in cases where Mr. A wishes to call up his own place of business from B's place, the exchange will, at B's request, charge the connection to A. Ordinarily, however, the party calling is charged with the connection.

No new subscribers are taken, as the company is only allowed to use its wires which were already placed; but old subscribers are being made toll agents at the rate of about fifty per day. No contracts for rental are being made, but an account is opened at the central office, and a record kept of all connections made from each instrument.

Outside of Indianapolis the people are unsparing in their denunciations of this work of imbecile or designing legislators. In Terre Haute, Lafayette, Richmond, and Fort Wayne, the toll system is gladly accepted, and is working with the best of success and satisfaction all round. City authorities, the people, the telephone company, all seem to want to do what is right, and, what is more, are doing it, while the opposition companies seem to be left in the condition of uncomfort enforced upon a poor boy at a frolic.

At least one of these companies was seriously disappointed when a municipal enactment, which required the removal of all poles, was rescinded. They expected to be the lawful inheritors of the post poles. It was a case of waiting for a dead man's shoes, where the man didn't die.

Owing to the falling off in the company's revenue it has been decided, for the present at least, to reduce the amount of quarterly dividend on stock, and in accordance with this action a dividend of one per cent. will be paid on the 24th of July.

The Thomson-Houston people have fairly settled in their new home in the Pullman building, and are quite cosy and comfortable. General Manager S. A. Barton has a desk here, and will hereafter divide his time between the Eastern and Western headquarters. The company has just started a 38-light plant at Jacksonville, Ill.

Governor Gray, of Indiana, and a committee from the legislature have recently visited Chicago, to look into electric lighting prior to selecting a system for the capitol buildings at Indianapolis. They had previously visited Jackson, Michigan.

A political reporter undertook to interview Governor Gray, but was squeezed out by the electric light gentlemen, who fairly whistled him down the wind and bore away the Hoosier official. At last accounts the Honorable gentleman was "doing quite well," and on the high road to recovery.

Think, for a moment, of the possibilities of the case of the country's future, when an electric light advocate can brow-beat and defeat that most indefatigable and brassy conversational inventor, a political newspaper man; in the presence too, of a real, live governor, whom he desired to interview.

License was granted on the 24th of June by the Secretary of State to incorporate the Badger Manufacturing Company, at Chicago; to do a general manufacturing business. Capital, $10,000. Incorporators, S. S. Badger, A. H. Badger, J. H. Stanwood.

Col. Lynch, broker at 146 La Salle street, gives the following as telephone stock valuations:

Chicago	$350 @	$360
Central Union	45 @	46
Michigan	63 @	65
Iowa Union	15 @	18
Great Southern	29 @	31
Great Southern, Script, 90 cents on the dollar.		
Colorado	18 @	20
Rocky Mountain Bell	40 @	45
Missouri and Kansas	54 @	56
Missouri and Kansas, Script, 55 cents on the dollar.		
United	15 @	17
Cumberland	65 @	70
Wisconsin	103 @	105
Bell of Missouri	45 @	50

CHICAGO, June 28, 1886.

Mr. J. F. Morrison, of Baltimore, has extended his already large electrical interests by the purchase last week of the Electric Light Company at Washington, D. C. The Morrison Electrical Works at Baltimore are now turning out dynamos, arc lamps and motors.

ELECTRICAL NOTES FROM KANSAS CITY, MO.

The Telephone Company in this city is increasing its list of subscribers, and now has about the same number as St. Louis, a city three times as large. The damage done by the recent hurricane has been remedied, new 50-feet poles taking the place of those that were broken down by the furious wind.

The Kansas City Electric Light Company, E. R. Weeks, superintendent, is one of the strong local institutions and is doing a splendid business and is rapidly increasing its plant throughout the city. This company's stock is all held by prominent citizens, and this guarantees, it would seem, an exclusive franchise.

The U. S. Electric Light Company is wiring the new Kansas City Custom House for the Weston incandescent light. This is quite an extensive contract.

The Consolidated Electric Light Company, of New York, is completing the wiring of the new Grand Missouri Hotel, which will be lighted throughout by the Sawyer-Man system of incandescent lights, which is owned by the Consolidated company. The Hess guest call and fire alarm has also been adopted by this hotel, the work of putting it in being done by O. W. Distch & Co., of this city.

KANSAS CITY, MO., June 25, 1886.

Electric Lighting.

This subject has recently been treated of in pamphlet form, under the above title, by one who has endeavored to sustain the waning importance of gas for illuminating purposes. The author directs his remarks particularly to stockholders of gas companies, who require something to encourage them not to lose faith in their investments, because of any supposed danger to their profits, by reason of the adoption of electricity for lighting purposes. He attempts to show that gas has as important a future before it, for purposes of illumination, as it ever had, and that it is capable of existing side by side with its new rival. His argument is depreciatory to the value of lighting by electricity. What he has to say is in many instances true, and the day has not arrived when it is safe to give up the employment of gas for many public and private uses. The relative importance of gas in the future is difficult to foretell, but there can be no doubt that it will find useful fields of employment, even if it should lose its present peculiar hold on popular favor, for a great many years to come. The light of the immediate future will certainly be that derived from electrical agencies, and the mechanical inperfections that may be now associated with it will soon be overcome and serviceable devices developed. At first, like all new enterprises of the kind, the electric lighting schemes partook of the speculative, and companies were formed and stocks sold more as adventures with no certain future. Failures followed, with few fortunate exceptions. Whatever is now undertaken is with the advantages of experience, and business methods are being applied, rendering the undertakings more reliable and permanent, and profitable to stockholders. Still there is much need of further experience, and the most economical methods for the best results cannot be expected till years and perhaps a generation has gone by. The matter of adopting the system of lighting factories by electricity has been much affected by the annual cost of maintenance as compared with gas, especially in small establishments, and where the loss of capital and interest in gas plants is involved. But this question or any doubt connected with it is being solved in the gradual cheapening and improving of all methods. In the case of a new mill, even now the cost would seem to be of comparative little importance, considering the convenience attending its management, its sanitary advantages, and particularly the fact that it can be introduced and used in among the machinery, where it is most needed, without danger of fire or other casualty. There are several points that should not be disregarded in the matter of employing electricity for lighting a factory, such as the increased safety from fire, the steadiness and agreeable color of the light, and the improvement in the air of the room. In this connection we have special reference to incandescent light, which is much less trying to the eyes than the arc light, not only in its color but in its steadiness. Should it fatigue the eyes, it can be mitigated by the use of ground glass, so that the glowing wire cannot be seen. The objection to the proceeding is the loss of light, varying from 10 to 20 per cent. In the immediate vicinity of large cities like Boston, the suburban villages will soon be accommodated with conveniently near electric stations, from which electricity can be provided for lighting purposes.—*Boston Journal of Commerce.*

What the Electric Time and Messenger Company Does for the People of Providence, R. I.

No review of the growth of the city of Providence and of the development of its business would be complete without some notice of the introduction of electricity into its varied industries, and the wonderful rapidity with which invention and enterprise have gone hand-in-hand in adapting it to the wants of modern civilization. Not only, says the *Star*, of that city, is the subtle fluid used in the transmission of intelligence by telegraph and telephone, and in lighting the streets and places of business, but it is employed in many ways little suspected by a majority of people. How many, for instance, know that in Providence, Pawtucket, Woonsocket, Newport and Westerly, and some of the smaller towns in the State, there are in use upwards of 800 electric clocks operated by the Electric Time and Messenger Company, whose office is at No. 54 Westminster street? By the use of these clocks not only do those who employ them secure accurate time, regulated by the standard, at very small cost, but they avoid all care of winding and setting. The man who consults an electric clock does not have to ask if it is "right," or how "fast" or "slow" it it is; the tale it tells may be received with implicit confidence.

At this office, also, may be found the sub-telephone exchange, or public station, which daily proves itself a great convenience, not only to the subscribers of the general exchange, who use it without extra charge, but also to the public at large, to whom the fees are very moderate.

The office of the American Telephone and Telegraph Company is also in the same place. The business of this company is exclusively long-distance telephoning, its wires extending beyond the limits of the lines of the Providence Telephone Exchange, including the cities of Boston, Hartford and New Haven. The circuits of the company will soon be completed to New York and Philadelphia, when a person in Providence will be able to converse with telephone subscribers in those cities with as great ease as with one in the next street.

A well-organized and carefully-managed messenger service is also a feature of the exchange. Here, at any hour from 8 o'clock A. M. to 9 P. M., the services of bright and active boys are always procurable, either by personal application or by telephone, to meet the requirements of the public in general and the patrons of the Telephone Exchange in particular.

The following well-deserved compliment also appears in the *Star:*

"To manage a business so varied, and having to deal with so delicate an agency, requires untiring energy and business capacity, and these are united in a remarkable degree in the person of Mr. C G. A. Peterson, who not only has the entire confidence of the companies which he so ably represents, but stands high in the estimation of the entire business community."

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* * Benton H. Gedge, of Covington, Ky., has recently been granted patents on several electric railway signals.

Telephonic News

⁂ The Mexican Central Telegraph and Telephone Company has declared a dividend.

⁂ The International Bell Telephone Company has declared a dividend of 3 per cent. on the capital stock, payable July, from the profits of the six months ended June 30.

⁂ In a new French method of diagonosis the condition of the eye is said to be accurately estimated by means of variations in sounds sent through a sensitive form of telephone placed against the eyeball.

⁂ The Bell Telephone Company has been granted permission by the Montreal council, to lay its wires in a shallow box-trough underground, alongside the sidewalk, the system to be approved by the city surveyor.

⁂ The Southern Bell Telephone Company has declared a dividend of 1½ per cent. regularly and 1½ per cent. extra, making $9 per share (one-half extra) this year, against $7 for the whole of last year.

⁂ Winfield B. Thompson, the young medical student who shot his wife and then took his own life in the Sturtevant House, New York, was formerly employed in the office of the Missouri & Kansas Telephone Company, at Kansas City, where he was known as a model young man.

⁂ The bill limiting the holdings of the American Bell Telephone Company to 30 per cent. in sub-companies has been ordered to a third reading by the Massachusetts Legislature, and that placing telephone and telegraph companies under State supervision passed to be engrossed.

⁂ A new telephone receiver has been recently patented by Wm. Marshall, of this city. It is arranged on the principle of an electrical condenser, consisting of alternate sheets of paper and tinfoil, with a circular opening in the center. The inventor claims that it is specially adapted for long distance work.

⁂ The Oram telephone time system is now used by the Montreal, Canada, telephone exchange, and is greatly pleasing the 1,600 subscribers of that city. This time system is now in use in three large cities, Chicago, Cincinnati and Montreal. The city of Toronto is also to be supplied with this time system as soon as the instrument can be manufactured in Canada.

⁂ Dr. Rogers, of Pan-Electric fame, is undoubtedly a gentleman of scientific attainment and most excellent judgment. He writes the ELECTRICAL REVIEW from Parthenon Heights, June 21st, as follows: "SIRS—Please find inclosed subscription to the REVIEW. No one interested in the marvels of electricity can afford to be without it. Respectfully yours,

"J. HARRIS ROGERS."

⁂ A combined transmitter and receiver telephone has been patented in this country by two French gentlemen. The telephone is provided with ring armatures at either end, reversibly mounted upon trunnions, an electro-magnet being arranged in the line with said telephone and in inductive proximity to the armatures, the circuit including the coils of the magnet. The application was filed in 1882, and patent granted June 22, 1886.

⁂ Several new plans are being discussed by the New York Subway Commissioners. It is expected that they will report in favor of an underground system at an early day. At the meeting of the Commissioners last week, Mr. Flower informed his colleagues that at the next meeting of the Commission he hoped to be able to present a series of resolutions, which, if adopted, would tend to make their work a good deal simpler than it has hitherto appeared, and expedite things generally.

⁂ The local company operating the Shaver acoustic telephone system in this city, have now upwards of 400 subscribers and are putting in new instruments at the rate of eight to ten per week. The average rentals charged here are about $3.50 per month.

⁂ It seems impossible to secure a quorum of the Philadelphia Electrical Committee of Councils to consider the ordinances granting the American Telegraph and Telephone Company and the Baltimore and Ohio Telegraph Company the privilege of laying wires underground. At each called meeting a quorum failed to be present. On Friday last another effort was made to have the bills ready for the meeting of Select Council, but only seven members responded to the call. After waiting fifteen minutes Mr. Abrams denourced the persistent absence of members, and said if the ordinances were for overhead wires there would be no trouble to obtain a quorum. He said one of the members of the committee, who is in the employ of an overhead company, positively refused to attend.

⁂ Adolphus A. Knudson and T. Gardner Ellsworth, who are the owners of patents for improvements in mechanical telephones, which, it is stated, they sold to the Independent Telephone Company for $14,500 in cash, to be paid in installments, and $125,000 in stock, have brought an equity suit against that corporation in Common Pleas Court No. 1, Philadelphia. The plaintiffs allege that the company has violated the contract made when the patents were sold, by selling State rights and failing to build and operate telephone lines. They ask the Court to enjoin the company from selling other State rights until the $14,500 has been paid, and from parting with what it has already received from such sales until it accounts to the plaintiffs. The appointment of a receiver is also asked for.

⁂ Mr. J. W. Burdette, of Burlington, Iowa, has completed arrangements for incorporating a company for the opening and operating of a Meucci telephone exchange in that city. The plan will be practically as follows: "A sufficient number of subscribers will be obtained to justify the enterprise, on the principle of catching the hair before pulling it out of the butter, and to each one will be sold a telephone, bell, battery and all, complete. The subscriber having purchased his instrument, will be given one share of stock worth $50, which, as now contemplated, will be transferable only with the telephone. With the cash capital thus provided the company will proceed to open an exchange, constructing all lines necessary to reach the subscribers and put them in connection with it. They will then be charged for exchange service only." This reads very nice, but, as the courts in the East have decided that the Meucci instrument is an infringement of the Bell telephone, the Burlington company will not be apt to pull many hairs from the butter if this fact becomes known in Iowa.

⁂ On the matter of the telephone situation in Indiana, the Terre Haute *Gazette* delivers the following vigorous remarks: "The real truth of the matter is that the last Legislature made an egregrious ass of itself in passing the telephone law. The United States granted a patent to Bell, and until it is proven fraudulent, and is cancelled, or has expired, no State has any more right to regulate the sum at which this service shall be furnished (the honorable Indiana Supreme Court to the contrary notwithstanding) than it has to fix the price of any other patented device. It was a wanton exercise of power which has cost the business community much vexation and trouble. To this class the telephone has become almost a necessity. All such subscribers, the *Gazette* included, while they will rejoice to hear of a non-infringing patent equally good, or the expiration, which will occur in a few years on the Bell patents, are determined not to be deprived of the convenience of using this wonderful invention and have no thanks to the Legislature, whose blundering action is likely to increase the cost of the service, instead of lowering it, until the law is repealed."

Early Experiments in Telegraphing Sound.

BY PROF. EDWARD C. PICKERING, DIRECTOR OF ASTRONOMICAL OBSERVATORY, HARVARD COLLEGE—COMMUNICATED TO THE AMERICAN ACADEMY OF ARTS AND SCIENCES, MAY, 26, 1885.

In 1870, when Professor of Physics at the Massachusetts Institute of Technology, I wished to show to an audience the experiment of transmitting sound by electricity. The only means of doing this, of which I was then aware, was by the sound produced when a piece of soft iron is suddenly magnetized or demagnetized. The sound thus produced is extremely feeble, and I proposed to replace it by the following device. Loud sounds may be produced by the vibrations of a plate, and a strong vibratory force may be applied to such a plate by means of an electro-magnet. The first receiver consisted of a powerful electro-magnet attached to the bottom of a wooden box, whose cover was replaced by a tin plate, to the center of which a soft iron armature was attached. The dimensions were such that the armature was near the magnet, but not in contact with it. The plate appear also to have been used without the armature. It is not certain but that this form of apparatus may have been tried first, and the armature added to increase the energy of the vibration, and consequently the loudness of the sound. A tin box was also employed, the bottom of which replaced the plate and armature, and the box served to reinforce the sound. The transmitter was composed of a sonometer, around the wire of which a short wire was wound, dipping into mercury. An electric current was passed through both wires, the mercury cup, and the magnet. When the principal wire of the sonometer was set in vibration by a violin bow, or otherwise, the current was broken at each vibration at the surface of the mercury. When the circuit was made, the magnet drew the plate down, and when it was broken, the elasticity of the plate drew it back. A loud sound was thus produced whose pitch could be varied by changing the length or tension of the wire of the sonometer. On December 13, 1869, I gave the first of eighteen lectures on sound, forming one of the Lowell Free Courses given that year at the Institute of Technology. It is probable that this experiment was prepared for and shown in the lecture of this course, which was delivered on January 5, 1870, and related to sympathetic vibrations.

On August 23, 1870, at the meeting of the American Association at Troy, Professor R. H. Van der Weyde, of New York, presented paper No. 141 to Section A, in the hall of the Troy Female Seminary, Professor John M. Ordway acting as chairman. This paper was entitled, "Further Improvements in the Method of Transmitting, Audibly, Musical Melodies by the Electric Telegraph Wire." In the discussion which followed the presentation of this paper, I described my experiment, and pointed out that my difficulty was mainly with the transmitter. Professor Van der Weyde's with the receiver; also that, if he could combine his transmitter with my receiver, I thought he might obtain valuable results. I have since been informed that he adopted this suggestion, and ascribes to it the use of the metallic diaphragm which he afterwards employed. The Troy *Press* of the following morning, August 24, 1870, contained the following report of my remarks. On account of its importance, I may be pardoned for giving it verbatim:

"Professor Pickering described a simple means he had employed for rendering these vibrations audible. It consisted of a simple electro-magnet placed close to the bottom of a large tin box, whose resonance rendered the sound very intense. His remarks were greeted with marked approbation. Another member said Professor Pickering's method was beautiful in the extreme, because it did away with the armature."

Professor Charles R. Cross, then Assistant Professor of Physics in the Institute of Technology, was invited to give a lecture on sound to the pupils of the New England Conservatory of Music, in February, 1872. He desired to show the experiment of telegraphing sound. Accordingly, Professor Cross, Mr. Waldo O. Ross (who was present at the experiment in 1870 also) and I spent an evening at the institute, and repeated the experiment of 1870 under more favorable conditions. The great difficulty in the early experiment was with the transmitter. A tuning-fork was accordingly substituted for the sonometer, which enabled the circuit to be broken with greater certainty and regularity. It was, however, open to the objection that sounds of one pitch only could be transmitted. The details of this experiment are known with much more greater certainty than those of the first experiment. The battery consisted of six small Grove cells. An "Albert biscuit" box, 20 centimeters long by 12 wide and 12 deep, was first used as a receiver. Afterwards, a large tin packing box, 80 cm. long, 50 cm. wide, and 50 cm. deep, was substituted for it, and gave a very loud sound. Most of this apparatus is still preserved at the Institute of Technology, and was used in the legal examination quoted below. In the last part of December, 1873, and the first week of January, 1874, a number of other experiments were tried by Professor Cross, and another exhibition of the instrument was made by him on January 7, 1874, at the first lecture of his Lowell Free Course of that year. Several forks were tried, and the receiver transmitted the characteristic sound of each, but one only was used publicly. The sound persisted when the magnet touched the box, but was then feeble.

Most of the above facts were testified to by Professor Cross in a legal examination held on June 18, 1879. It was agreed that the same deposition should be used in the two cases, Harmonic Telegraph Company *et al. vs.* the New England Telephone Company, and Harmonic Telegraph Company *et al. vs.* Chas. Williams, Jr. Present: Causten Browne, Esq., of counsel for complainants; Chauncey Smith and J. J. Storrow, Esqrs., of counsel for defendants; and W. P. Preble, Jr., examiner. Professor Cross also testified as follows:

"*Ans.* On the 10th of June, 1879, I tried a number of experiments with this receiver, which was set up in a manner similar to its arrangement in the exhibition already mentioned, it being in the office of Mr. J. J. Storrow, Union Building, State street, Boston. It, together with a Blake transmitter, was connected in the primary circuit of a battery, the transmitter being placed in Room 42, Union Building, and connected with the receiver by wires stretching across the open court separating these two rooms, and about one hundred feet in length. A second circuit, containing two ordinary hand telephones, was stretched between the two rooms, so that any messages sent by the apparatus which I am describing could easily be verified.

"The magnet in these experiments was placed near to the outside of one end of the tin box, which rested upon its side, and when faint sounds were transmitted the head was placed inside the box, with the ear opposite the poles of the magnet, in order to detect the sounds. I first asked Mr. Watson, who was assisting me, to play a small mouth harmonica before the mouthpiece of the Blake transmitter. I was expecting to hear the sound given by that instrument, and so was somewhat surprised to hear loud and clear notes resembling those of a music box. On inquiring of Mr. Watson what instrument he had been using, I was informed that he had been transmitting the sound produced by a child's music box which he happened to have there. Afterwards the mouth harmonica was substituted, and its characteristic notes clearly perceived. In both of these cases the characteristic pitch and quality of the tones in the musical instruments used could be heard at the distance of eighteen inches or more from the receiver. Mr. Watson was then asked to speak into the transmitter, and, while the ear was still at a distance of about fifteen inches from the receiver, a sound was heard which was recognized as articulation, although the words could not be distinguished

at that distance. I then placed my ear close to that portion of the box which was opposite the poles of the magnet, and asked Mr. Watson to speak into the transmitter. I then without difficulty was able to hear a number of sentences, which were entirely unexpected to me.

"Int. 9. Please state whether on this occasion you also tried to transmit articulate speech, using as a receiver a common hand Bell telephone connected upon the circuit, with the mouthpiece and ordinary diaphragms removed, and the instrument held against one end of the tin box, so that the box should take the place of the diaphragm. And if so, with what result?

"Ans. I did. With it we succeded in transmitting articulate speech from one station to the other with very great ease.

"Int. 10. Will the Institute of Technology give or sell the defendants the receiving apparatus you constructed, to be filed as an exhibit in this case? and if not, will you please produce duplicates of said tin box and horseshoe electro-magnet, and a wooden box like the one used in your experiment?

Ans. The early experiments have so much interest attached to them that it seems desirable to retain the original apparatus in the possession of the Department of Physics. I will produce duplicates."

Copies of the apparatus were also presented, in May, 1885, to the defendants in the suit in equity, American Bell Telephone Company *et al.* *vs.* The Western Pennsylvania Telegraph and Telephone Company *et al.*, Circuit Court of the United States, Western District of Pennsylvania, on motion for preliminary injunction. At this time, also, it was shown that articulate speech could be transmitted by the apparatus, by attaching a mouthpiece to one prong of the tuning fork and placing a piece of carbon in the mercury under the style. Affidavits were also produced from Mr. G. W. Blodgett and Mr. L. W. Wood, stating that I showed the apparatus described above to their class, in 1873. An affidavit of Mr. A. D. Blodgett shows that it was also shown to his clase by Professor Cross in 1874.

The following extract from a letter to Professor Bell may also be of interest, as showing that I advised him to increase the sound of his telephone by an instrument resembling the Blake transmitter, in 1877, or two years before the invention of that instrument. This letter was written during the night following Professor Bell's communication on the telephone to the American Academy, on May 4, 1877. The telephone then exhibited gave a feeble sound, and, according to my letter book, I wrote on "the problem of introducing more kinetic energy into your telephonic circuit, in other words, on making a telephonic relay. An idea occurred to me which I hope may give the desired result, and I shall be very glad if you have the means of giving it a trial. The problem is to utilize a local current, so that in a given circuit it shall be proportional to the current induced by the magnets. Now, this may be done by attaching to the plate of the receiving telephone *A* a fine wire dipping in water, and nearly touching a wire connected with a second telephone and battery. The resistance of this circuit will be mainly that of the water between *B* and *C*. Now, as *A* vibrates, the interval *B C* will alter, and with it the total resistance, and consequently the current. Moreover, a feeble exciting current may regulate a powerful local battery." A sketch of the apparatus showed that the current from the battery passed through the vibrating diaphragm of a receiving telephone, to which was attached a wire *B*, dipping in water, and nearly in contact with a second wire *C*. The variations of the current thus magnified were then passed through a second telephone. A modification of the apparatus was also described, by which the current could be reversed, like the primary current. Had this instrument been tried, a loud-sounding telephone might have been obtained earlier. A carbon button should have been substituted for the liquid resistance, as the varying resistance of carbon was then well known.

No secret was ever made of these experiments, which were described and exhibited publicly and privately whenever this was desired. A patent for the apparatus was not taken out, from a belief that a scientific man should place no restrictions upon his work which would tend to prevent the repetition of an experiment of scientific interest. A full description should have been published. This was at first delayed from the pressure of other work and lack of appreciation of the importance of the results. Afterwards I was unwilling to enter into a controversy, or to obstruct my friends, who were struggling to obtain proper recognition of the great results they had obtained in the same field. Now that some of them at least have been amply rewarded, a full statement seems necessary as a contribution to the history of the telephone.

It will be seen from the above statement that in 1870, several years before the telephones now in use were invented, a receiver was devised, constructed and tried, which consisted of a flexible iron diaphragm, supported at the edges, and replacing the armature of an electro-magnet. Musical sounds were telegraphed successfully, and the apparatus was described at a scientific meeting, as the newspaper report shows. In 1872 and later, the experiment was repeated under various conditions. In 1879 it was shown that it was capable of serving as a telephone, and of rendering articulate speech audible at a distance. It appears to differ in no way in principle from the receiver now used. On the other hand, it should be stated that all my experiments were made, or were intended to be made, with a discontinuous current, and, although the instrument is capable of showing the variations of a continuous current, I did not have this application in mind when I constructed it.

Water Jets and Musical Tones.

At a recent meeting of the Berlin Physical Society, Herr C Baur described experiments he had made with water-jets, which, issuing from a conically-pointed tube in parabolic curves, were acted up by certain musical tones, so that, at some distance from the mouth of the tube, they showed a rotation, and that the jet, though broken up into drops behind the apex of the parabola, contracted into a continuous jet. The thinner the jet was the higher must be the tone towards which it was sensitive; the thicker the jet the deeper the tone. Herr Baur had instituted further experiments with water-jets, which he caused to fall on plates. Under certain circumstances there thus arose quite pure tones, which continued as long as the jet hit on the plate. The experiments succeeded best with a Weissmann apparatus, when the jet issued under a pressure of 10 cm. water from a lateral opening of 4 mm. in diameter without tube. Thin window-glass plates and metal plates, which, resting on pedestals, had free movement of vibration, were best suited as receiving plates. The tone was most certain of occurrence when the node lines of the plates were supported. In the jet itself appeared nodes and ventral segments at some distance from the opening. They were most distinct and regular at its middle; away in the direction of the plates they again became indistinct. If the metal plate and the watere, acidified beforehand, were connected with a galvanic cell and a telephone, then no interruption of the current could be recognized during the time of the sounding. The contact of the water-jet with the plate must necessarily, therefore, be continuous. Herr Baur deemed this mode of excitation very well adapted to the purpose of studying the vibrations of plates.

.... Gen. Thomas T. Eckert, General Manager and Vice-President of the Western Union Telegraph Company, testified in its behalf in Gen. Farnsworth's suit against it for cutting the Bankers' and Merchants' wires. He testified that he went to see Gen. Farnsworth, at 187 Broadway, on the 10th of July last, and demanded possession of the American Rapid Company's property, showing the order of court giving him possession. Gen. Farnsworth said he could not see how the American Rapid and Bankers' and Merchants' property could be divided, they were so mixed up. Finally Gen. Eckert left Mr. Stewart of the Western Union Company in charge at the operating room, and went back to his own office. Gen. Farnsworth then ordered Stewart to leave the building. Gen. Eckert, when Stewart came to his office, told him he must go back and cut the American Rapid wires. Stewart knew the wires, and Mr. May said they were readily distinguishable. After giving the order Gen. Eckert took the steamer for Long Branch. There he received a despatch that an injunction had been granted restraining the cutting of wires, and he ordered that no more be cut.

The New Telephone Causes Trouble in the Family.

"After your boy, Jake, again?" queried the sergeant, as Mr. Dunder entered the Woodbridge street station yesterday.

"Yes, I vahs after Shake. He slipped oudt yesterday, undt I like to find him."

"Made you some new trouble, I suppose?"

"I tell you how it vhas. I put in a telephone a few days ago, und eafery time der bell rings my wife likes to run und answer. Yesterday morning Shake goes oudt for a leedle while, und pooty soon der telephone rings My wife runs oafer und yells hello! und somepody says:

"'Vhas dot Mrs. Dunder?'

"'It vhas.'

"'Vhell, Mrs. Dunder, how vhas you pleased mit all dose things?'

"'What things?'

"'Dot new bonnet und wrap und silk stockings dot Mr. Dunder buys at my shtore two days ago und takes home to you?'

"I vhas behind my bar when Mrs. Dunder drops dot telephone und comes oafer to me und says:

"'I haf discovered all aboudt it! You vhas buying clothes for some womans!'

"'Who says dot?'

"'Somebody in der telephone.'

"'I vhill kill dot person pefore night!'

"I goes mit der telephone und pounds on der pox und rings der bell, und call hello! mit all my might, und somepody asks:

"'Vhell, who you vhant?'

"'I vhant dot person who vas lying to Mrs. Dunder!'

"'Oh! come off!'

"Und nopody answers me any more. Mrs. Dunder scolds und cries, und I vhas so madt dot I shut oop my saloon. After a while dot telephone rings werry sheerly, und I listen und hears Shake say to somepody:

"'Say, Bill, you drop down und see if der oldt folks hof tumbled to dot racket. Dot vhas a big shoke on der gofernor.'

"Now, Sergeant, I like to find Shake. He vhas a shmart poy, und he vhas all right, but I like him to come home. I vhas anxious to haf some interviews mit him. It vhas a werry cool place down cellar for some interviews. If you see him you can say dot I laugh all oafer mit his shoke on me. Afterward, when you see him, you can ask him if he laughs all oafer mit my shoke on him. He vhas shust a leedle too flies, und now, in his young days, vhas der time to correct his habits."—*Detroit Free Press.*

Reduction in Rates for Telephone Service at Private Houses.

The following circular has been sent out by the Metropolitan Telephone and Telegraph Company, of New York:

"NEW YORK, June 21, 1886.

"*Sir*:—I beg leave to inform you that after July 1, telephone services will be furnished to private residences, in districts covered by our wires, at $100 per annum, upon the usual form of application, which will be furnished by the company at the request of applicant.

"This rate is for strictly private residences. Where office and residence are in same building the rate is $150 per annum.

"Any corporation, firm or individual having telephone exchange service at its or their place of business, will be entitled to the service at their residences, if strictly private, at the rate of $75 per annum—provided they can be reached by our wires.

"Subscribers already having the service in their residences, desiring to avail themselves of these reduced rates, will please send their copy of contract to have the reduction duly recorded on the same by the company. If not so recorded, bills will be rendered at old rates, as heretofore.

"Two persons living near each other, and within our exchange limits, can obtain telephone service for domestic and social purposes at $75 each per annum, if they will use one wire in common, which is known as 'circuit-wire service.'

"Awaiting your further favors, I am,

"Very respectfully,

"H. S. HUIDEKOPER,

"Vice-President and General Manager."

TELEGRAPHIC

.... The ordinance regulating the laying and construction of underground wires, electrical conductors, cables and tubes in Philadelphia has been passed finally by the Select Council. A number of other ordinances asking for permission to lay conduits were postponed in order that they may be made to conform to the general bill, except one granting the Keystone Electric Light and Power Company permission to light a few streets in the central part of the city by electricity conveyed underground, which was thought to be a necessity, and another permitting the Electric Pneumatic Transit Company to lay tubes under certain streets for the purpose of transmitting messages. These two were passed.

.... The following persons were elected officers of the American Association of Train Dispatchers, at the annual meeting at Chicago: President, G. W. Babbitt, Michigan Central. St. Thomas, Ont.; vice-president, Frank J. Martin, Buffalo, New York & Philadelphia, Olean, N. Y.; secretary and treasurer, E. J. Peabody, Chicago, Milwaukee & St. Paul, Marion, Ia. It was determined to admit no persons to membership who had not had two years of active experience as train dispatcher on some surface road, and was not at the time of his application in active railroad service. Provisions were incorporated in the constitution for the control of local branch organizations, which it was determined to recognize. The $3 initiation fee of the National Association was abolished, and $2 fixed upon as annual dues from each member of every local branch to the National Association. It was also provided that local branches should send delegates to the annual convention.

It Nearly Paralyzed Him.

Edward Harland, receiver of the American Rapid Telegraph Company, was one of the principal witnesses for the Western Union Telegraph Company in Receiver Farnsworth's $2,000,000 suit against it for cutting the Bankers and Merchants Company's wires. Mr. Harland said that on April 18, 1885, when he was appointed receiver, he got possession of very little of the American Rapid's property, and did not demand possession of Receiver Farnsworth. On July 10 he made the contract with the Western Union giving them the use of the American Rapid property during his receivership for $5,000 a month. He first saw Jay Gould about the matter, and when the contract was signed Gould, Dr. Green, Gen. Eckert, and Judge Dillon were present.

Col. Ingersoll asked the witness how he came to see Mr. Gould.

"Mr. May told me that Mr. Gould wanted to see me," was the answer.

Q.—Why did you object to the Bankers' and Merchants' getting possession of the American Rapid? A.—It seemed to me they were trying to extinguish it.

Q.—If the Baltimore and Ohio had offered you $70,000 a year would you have taken it? A.—I would have snapped at it.

Q.—But you only went to see Mr. Gould? A.—Yes.

Q.—And you would not have any interview with Stokes and Sully? A.—I didn't suppose they would give any more.

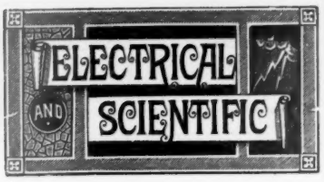
Q.—When you heard Jay Gould wanted to see you you trotted right down to his office? A.—No, I walked down.

Q.—Why didn't you let Stokes and Sully know you proposed to sell? A.—They were antagonistic.

Q.—So you corked yourself right up as soon as you got to Gould's office? A.—I tried to cork myself as tight as I could.

Q.—You think that the best way to get the highest bid is to cut off all competition? A.—No.

Q.—When you got a bid of $5,000 it kind of paralyzed you? A.—Well, it did. I didn't have a cent. I told the counsel about it, and the offer making 2 per cent. on the bonds. I concluded to take it.



* * Wax may be made into a liquid to be used in writing by dissolving it in alcohol, ether, or some essential oil. After written with, evaporation will leave the characters present in wax.

* * It is estimated that when the Lick telescope shall be finished and set in position it will have cost $161,850. The observatory dome will cost $56,850, the mounting $42,000, the visual objective $53,000 and the cost of the photographic objective will be $13,000.

* * We have it on the testimony of a reliable man that buttermilk mixed with fine sand, and applied to new woodwork outside, will stand for many years, and gives the most complete imitation of stone it is possible to get, and with it absolute preservation of timber.

* * If the privilege is granted, the coporation controlling the new electric street car company in the District of Columbia will be known as the Washington Central Electric Railroad Company. The road will be constructed and equipped by the Bentley-Knight Electric Company, of New York, and the Rhode Island Locomotive Works, of Providence.

* * A curious invention has turned up in Italy. It consists in the application of light-giving materials to printing ink, by which print becomes luminous in the dark, so that in the future it will be possible to read at night, in bed, or during a journey, without the assistance of candle or lamp. A new daily paper, in which this luminous material will be used, is, it is said, about to be published at Turin.

* * Meterologists have found that there can be no thunder and lightning without rain. When thunder is heard beneath a clear sky, the reports must either come from distant clouds or be the result of some other cause than a discharge of electricity. Harvest or heat lightning is produced by a distant storm. Thunder seldom ever accompanies heat lightning, the sound reaches only twelve miles, while lightning is often seen by reflection upon nearer clouds at a much greater distance.

* * Wood oil is now made on a large scale in Sweden from the refuse of timber cuttings and forest clearings, and from stumps and roots. Although it cannot well be burned in common lamps, on account of the heavy proportions of carbon it contains, it furnishes a satisfactory light in lamps especially made for it, and in its natural state is the cheapest of all illuminating oils. Thirty factories produce about 40,000 liters of the oil daily. Turpentine, creosote, acetic acid, charcoal, coal-tar oils and other useful substances are obtained from the same materials as is the wood oil.

* * The opinion is expressed by an eminent American scientist, in a recent lecture, that the North American continent had the beginning of its formation in islands of matter rising out of the immense ocean, which grew until they finally touched each other. Many of these islands were volcanoes that threw up matter that had formed below the surface of the water, and were larger below the water than above it. The Hawaiian Islands had had many volcanoes, and were much formed by them. Their whole area above the sea is no more than that of the State of Massachusetts, but their combined bases must be equal to the whole of New England and New York united. Thus the original islands of this continent could easily have been made to enlarge and join each other, and the granite rock so abundant was doubtless once erupted from volcanoes, like flowing lava. Among the first volcanic islands must have been Greenland, Canada east of Winnipeg, the Atlantic district, the Rocky Mountains and the Sierra Nevadas; but as the islands rose and enlarged great depressions would naturally commence and go on, and in this way the depressions of Hudson's Bay, the Mississippi valley and the Salt Lake and Nevada basins were formed. These depressions would fill with massive sediments, which would eventually become rocks, and the depressions would have a saucer or platter shape.

Electric Lighting at Silvertown.

One of the most interesting and important of the series of excursions which have been planned for the instructoin or amusement of the various Commissioners at the Colonial and Indian Exhibition, is that which took place yesterday at the India-Rubber, Gutta-Percha and Telegraph Works, Silvertown (England). We propose to take advantage of the occasion to lay before our readers an account of those important works. In the present issue we shall confine our attention to the electric light installation, and at an early date shall describe the manufacturing plant.

For some time past the telegraph works of the India-Rubber Company have been lighted by electricity, the object being twofold, viz.; firstly, to show the adaptability of the electric light for use in factories where a very large variety of work is done; and, secondly, to prove that this method of lighting is economical as compared with gas, especially when carried out on an extensive scale. As the factory covers a large area, and there is this great variety of work in the several shops, it was decided that the plant would have to be mixed, *i. e.*, partly arc lighting and partly incandescent. The incandescent light plant has not yet been completely laid down, but in a short time it is hoped that it will have been extended throughout the remaining portion of the works, viz., the engineering and instrument making departments.

With one or two exceptions the whole of the generating plant is arranged on the ground floor of a building set apart for that purpose, and situated in the most favorable position at command. Built out as a wing to this building is the engine and boiler-house, in which have been placed two compound semi-portable engines with multitubular boilers, each engine being capable of indicating up to 130 to 140 horse-power when worked with 140 pound steam pressure. Each engine drives on to a line shaft which is carried through a wall-box into the main building, across the whole length of which the two shafts extend. Each of these shafts gives motion to ten sets of overhead counter shafts with separate striking gear, these countershafts, in their turn, driving the dynamo machines, which are arranged in two rows across the building, a passage being left between them, so that they can be easily attended to. The dynamos used for the arc lighting are of the double disk pattern, which was the then existing Silvertown type at the time the installation was commenced. Two machines are mounted on the same bed-plate with their generating coils, of the disk pattern, on the same shaft, and are so arranged that by means of a small switch on the frame of the machine, the change from full to half load, or *vice versa*, can be made instantaneously. Twelve of these machines were put down, each being capable of maintaining fourteen to fifteen arc lamps of 2,000 candle-power, but in the normal condition of affairs only ten dynamos are required, the other two being kept in reserve.

The incandescent light machines, four in number, are of the later pattern adopted that is, machines with a cylinder armature of the Gramme type rotating between two vertical magnets having consequent poles at their centers). They are both lighter for a similar output, and more efficient than the machines of the older type.

The leads from the arc light machines are conducted overhead to switchboards, inserted as panels in the wall of a small test room situated at the end of the passage-way facing the machines. These switchboards are built up of two sets of insulated brass bars, one set let into the face, and the other, at right angles to the first, into the back of a board. The leads from the machines are connected to the front bars, and the lamp circuit leads to the back bars; each front bar has a row of plugholes in it, one hole being carried through into each of the back bars, so that by means of two plugs any machine can be connected to any circuit, the leads of which come to the switchboard. These plugs, however, are never used to break the circuit, a switch mounted on the top of the board in each lamp circuit being provided for this purpose. Above each switch, and carried on the frame of the switchboard, is a current meter connected up with the circuit which that switch controls. This meter is also arranged that the normal working current deflects the index to its central position, but, should the current increase or decrease beyond the safe working limits of the lamps, the index makes contact with a stop on one side or the other, and closes the circuit of an electric bell which gives warning to the man in charge. In order to prevent the bell from ringing when the circuit is broken at the main switch, a small auxiliary contact in the bell circuit is fixed on the switch lever itself, and this breaks the bell circuit when the switch is open. Inside the small test room, at the back of these boards, are plugholes in the machine terminal bars, to enable the attendant to take the electromotive force of each machine, and also plugholes in the lamp circuit bars to enable him, without breaking the circuit, to plug in or out resistance coils which are fixed to the walls of the room above the switchboards.

The leads from the incandescent light machines are brought in a similar manner to a terminal board, connection being made between the machine terminals and the terminals of the lamp circuits, by bars of copper, of a section suitable for the heavy currents to be dealt with. As there are about thirty conductors leading from the test room to the various circuits, it was decided to lay them under ground. For this purpose a concrete trench was made, running the whole length of the main road, with branch trenches leading off on either side to the buildings to be lighted. The conductors, which were all of ample size for the current to be carried by them, and well insulated with India rubber and put under lead, were drawn into the trench after it was covered up, manholes having been provided at every junction of the main and branch trenches. This method of running the main leads has proved quite satisfactory, as we are informed that although these leads have been down now for three years in a trench which, for at least six months out of the twelve, is full of water, there has never been any failure of insulation nor any expense incurred after the first cost of making the trench and putting the leads into it.

The arc lamp in use, of the Silvertown type, has a clockwork movement, the last wheel of the train being governed by a detent, actuated by an elecero-magnet wound in derivation. These lamps, of which there are altogether 137 of 2,000 nominal candle-power inside the building, and 10 of 3,000 nominal candle-power in the yard, are each connected with a switch, so that they can be cut out for trimming purposes, etc., without interfering with the other lights in the circuit. The inside lamps are suspended from the ceilings of the shops, lowering gear being provided where it would not be possible to trim them in their normal position; the outside lamps are carried on jibs fixed on ribbon poles, or on the corners of buildings, and are all fitted with gear for lowering them from their normal position, which is about 40 feet above the ground. It is claimed for these lamps that the clockwork movement gives them a good, steady feed, and renders it easy to regulate them, so that they are not liable to overfeed when subjected to vibrations from heavy machinery, such as is in use in the cable and India-rubber departments.

The incandescent lighting, at present in working order, comprises nearly 800 lamps, distributed in the waterproof, hose, belt and other workshops of the india-rubber department, the ebonite shops and general offices. This number will, however, be increased to about 1,100 when the engineering and instrument departments are completely fitted up The lamps used are of 100 volts and 16 candle-power, and are arranged in parallel, the lamps in each circuit being divided up into several sub-sections, each controlled by a switch, it being found unnecessary, except in a few cases, to put on a separate switch to each lamp. As before stated, all the power for these lights is not obtained from what may be called the central station, the two exceptions being: 1. In the telegraph cable shops, where, although under ordinary circumstances the forty-six lights in use are run from the central station, provision has been made to run them from the engines in the various shops, in case, as frequently happens, lights are wanted all night in any of the cable shops. 2. In some parts of the india-rubber department the light is required throughout the day, and a dynamo has been put down and is driven from an engine supplied with steam from the main boilers of the india-rubber department. This circuit, however, is still connected with the central station, so that if necessary the lights could be run from that place, or, on the other hand, a circuit generally run from the main dynamos could be supplied with current from the machine in the india-rubber department. As this machine frequently runs from 6 A M. till 9 P. M., it will be seen that a considerable economy is effected by its use, as otherwise it would be necessary to keep up steam in the main electric lighting boilers and run one of the main engines with its shafting in order to supply current for about 100 lamps, that being about the number required throughout the middle of the day.

We regret that we are unable to give in a tabulated form any exact figures respecting the comparative cost of lighting these works by gas and by electricity, because the actual floor space to be lighted has in the last four years been increased from about 6¾ acres to 10 acres, or nearly 50 per cent., and because the cost of lighting these new buildings by gas can only be got approximately by calculation, as the majority of them have never been fitted up for gaslight at all. We are informed, however, that a comparison made in the following manner shows highly satisfactory results. The cost of gas lighting for the year 1885 was calculated as being equal to the average of the gas bills for the years 1881, '82, '83, multiplied by the ratio of the floor space to be lighted now, to that which was in use in 1882, no addition being made to the bills for interest or depreciation of gas plant. The cost of the actual lighting for 1885 was taken as equal to the cost of the gas used during the year, added to the cost of maintenance of the electric lighting plant, with 10 per cent. on the total capital outlay for interest and depreciation. These figures show a saving of between 16 and 17 per cent., and this will be still further increased when the remainder of the incandescent lights are in use, as the only additional plant required will be lamps and branch leads, the power and main leads being already provided.

This result is especially gratifying to the company, as the dynamo machines, the cotton covered wires, the arc lamps, leads, switches and other fittings have all been entirely manufactured by themselves at Silvertown, and the whole installation has been planned and carried out by the permanent staff of their electric light department. —*London Engineering.*

The Polarity of Tadpoles.

The following is reported about an interesting experiment of the physiologist, Prof. L. Herman: In a flat bowl filled with water, in which a number of fourteen-days' old frog larvæ (of *rana temporaria*) were disporting themselves, were sunk along the narrow side, ready for an experiment, thick zinc wires, connected with a battery of twenty little zinc carbon elements. When the current was made, the whole of the little animals fell into a wriggling motion, which soon ceased. But all the larvæ, without exception, had taken up one position, in which the head was turned to the anode and the tail to the cathode. The animals remained in this position till the current was again broken, when they again fell into the wriggling motion, but now less violently. Repeated experiments proved that the living animals showed a decided polarity, placing themselves along the stream lines of a current with their heads all in one direction, this direction being reversed when the current was reversed. An explanation of this interesting phenomenon has not hitherto been given.

Electric Lighting as an Investment.

With a view to put at rest the question whether local electric lighting companies are profitable investments, a contemporary, *Scientific American*, recently addressed a circular letter to the general managers of a number of such companies, both East and West, asking for their experience in the matter.

Answers was received from all parts of the country, and the general tenor of the replies is that many of their local companies are earning better dividends than are yielded by the majority of other new enterprises. The question of profit rests first with the locality, and then, if this be judiciously chosen, with the system employed and the ability displayed in the management.

Of those who have stated the exact profits of their investment, the highest returns came from Omaha, Nebraska, where a company, operating four 30-light dynamos, had earned at the end of the first three months after incorporation 4½ per cent. on the investment, or at the rate of 18 per cent. per annum. Two more dynamos of the same capacity have since been added to their plant. The gentlemen connected with this company are so well pleased with these results that they procured a franchise for operating in Des Moines, Iowa. They began by running 65 arc lamps, but have since increased their plant.

Replies were also received from Washington, St. Louis, Worcester, Terre Haute, Auburn, Me., Salem, Mass., Quincy, Ill., Kansas City, etc., which confirm these results, and state emphatically the belief of the writers in the desirability of electric lighting as an investment.

There is room for great extensions of these local lighting companies in all parts of this and foreign countries.

What a Chicago Editor Has to Say About Detroit and its Electric Lighting.

Mr. John J. Bohn, one of the editors and publishers of the *Hotel World*, of Chicago, a few days since visited Detroit, Mich., and expresses his sentiments as follows, which in view of the fact that the National Electric Light Association meets there in August, will be of interest to our electric light readers:

"To speak of the singular beauty and charm that the City of Detroit has in store for the visitor at this season of the year, would be to repeat what hundreds of others have affirmed before, and rather than have the reader make that most unpleasant though perhaps appropriate criticism, so forcibly implied in the word "chestnuts," it is perhaps better in most cases to check one's enthusiasm and bear lightly on that which is uppermost in the mind of the traveler who is so fortunate as to visit Detroit at this season. For 'what is so rare as a day in June?' (in Detroit.) Detroit is justly entitled to stand front and foremost in making herself the most poetry-inspiring city in America. Do you ask why? Does she not say $110,000 a year for the sole purpose of surrounding a naturally beautiful city with a halo of soft and mellow light, the beams of which, after twilight, steal from heavenward through the foliage of the thousands of silver-leaved trees that line every street and avenue? The good citizens admit that placing the light on 300-foot towers does not make a practical light. There are many dark corners which the ethereal light does not pervade. When the slanting rays from the tower strike the side of an eight-story building they do not shine through and light the other side. But the citizen of Detroit who would advocate the taking down of the towers and the replacing of the gas-lamp on the corners has no poetry in his soul. The citizen of Detroit who can sail down the Detroit River late in the evening and see his home in the midst of the glittering trees, and the thousands of glistening leaves that are made ten-fold more beautiful through the heavenly, though artificial light, and not feel grateful that he may live in such a bower of foliage, all so resplendent, should go and hide himself for a time in some cave. It is wrong to be enthusiastic when it comes to the expenditure of dollars and cents, and especially when they must be to a 'monopoly,' but it is here suggested that by all means 'let the light shine.' The score of hotel men who last week returned on the delightful excursion in the evening from Mt. Clemens, and saw Detroit 'under the electric light,' well know that it is a sight that must be seen, and seen from the water, to be appreciated."

—— The Norristown (Pa.) Electric Light Company has decided to purchase the plant and put in an incandescent system, and operate it along with their Thomson-Houston plant.

—— The Ball Electric Light Co., of 63 Equitable Building, Boston, have just installed a thirty-light plant of their popular system at Rochester, N. H., for stores and street lighting, and it is giving perfect satisfaction.

—— Messrs. Holmes, Booth & Haydens have just issued a valuable little table giving the maximum safe carrying capacity of bare copper wire, which can be had without charge, and which is sure to be popular with all electric light operators.

—— At the Summer-Night Festival of the Liederkranz Society, this city, held at Washington Park, Saturday evening, 26th inst., there was a very fine display of electrical effects produced by Mr. Alexis Olenin, of this city. Over 1,000 incandescent lamps were used in set pieces.

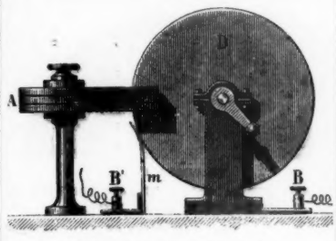
—— The Forest City Carbon Manufacturing Company, of Cleveland, Ohio, have opened their extensive works, after devoting three months to putting in entirely new machinery. Their new carbon is known as the "Austrian-American Cored Carbon," and is reported to have greatly pleased all electric light men who have tested it. The Messrs. Holmes, Booth & Haydens are the sole agents of this carbon, which fact is a guarantee of its excellency.

—— The Lalande primary battery, which has been introduced into England for electric lighting purposes, was recently subjected to a series of tests by Dr. Lummel, a German physicist. The element consisted of an iron vessel having its bottom covered with peroxide of copper. The neck was closed by an india-rubber stopper, through which passed a zinc cylinder, and the exciting solution was a potash lye. The products of the cell are zincate of potassium and metallic copper. The electromotive force of the cell was determined by Dr. Lummel to be from 0.5 to 0.8 of a Daniell cell, and the internal resistance 0.1 Siemens unit. With a Siemens unit in the external circuit, the cell gave a current of one ampere. After six days' working through this external resistance, the strength of the battery was found to be unimpaired. The inventor states that the battery, if exhausted, can be restored by passing a dynamo current through it; but Professor Helmholtz points out that this can only happen when the currents are so strong that the iron becomes passive and the copper oxidized.

—— Messrs. Andrews & Co., England, have just completed an installation of about 100 lights on board the ss. Dynamic, which has been under alteration by Messrs. Workman, Clark & Co., of Belfast. The current is supplied by one of Andrews, patent dynamos, running at a speed of about 500 revolutions per minute. The light has been distributed throughout every portion of the ship, with the exception of the signal lamps. Two clusters (portable) of three 50 candle-power lamps each are used to light the hatches when loading or discharging cargo. The fittings throughout have been manufactured by Messrs. Andrews & Co., and are of a thoroughly substantial character, and admirably suited to their various positions, says our London namesake. The light in the saloon is especially brilliant, and the handsome nickled fittings give it a very effective appearance. One particular which is worthy of note is the despatch with which the electrical outfit has been completed, the vessel only having been laid up for a fortnight, and the trial of the electric light having been made with the most satisfactory results the night before she left the dock.

Faraday's Disk Dynamo.

The cut shows a horse-shoe magnet mounted upon a suitable frame. Adapted to rotate on horizontal axis between the poles of the magnet is a copper disk *D*; *B B* are binding post, and *M* a flat brush bearing upon the circumference of the disk. By rotating the crank a current will be generated, or by coupling the machine in circuit with a Bunsen battery the disk can be made to rotate. The little machine can be easily built, and many interesting facts can be learned from it. Many well known electricians are now experimenting with a view of producing a commendable machine working on this principle, a result not yet attained.



FARADAY DISK DYNAMO.

—— A new method of lighting, called the pneumatic system, has been described by a Frenchman, M. Bender. He employs the fatty residues obtained from the rectification of crude mineral oils, through which he passes a current of air. The air takes up a definite quantity of this hydro-carbon, and the flame produced is very brilliant, giving off no smoke. Cheapness and immunity from explosions are the advantages claimed.

—— The title to the McQueen Locomotive Works at Schenectady, N. Y., has been transferred to Thomas A. Edison, who will make certain alterations in the establishment and remove his entire manufacturing business to that city. Edison recently suffered heavy losses by a strike of his workmen, and in order to avoid anything of the sort in the future, he has determined to move his works from New York City.

—— Mr. Warren de la Rue has arranged his chloride of silver battery in a new or dry form, which is reported to adapt it better for the purpose of maintaining small incandescent lamps alight. The cell consists of a flat glazed earthenware tray containing a sheet of silver foil on its floor. Dry powdered chloride of silver is spread over this plate, and a vegetable jelly is laid over that to support the zinc plate, which is the upper pole of the cell. This jelly is made by dissolving a solution of chloride of ammonium (2½ per cent. of the salt) in Ceylon moss or "Agar-agar." A pile of these cells makes a small convenient battery.

—— The electric illumination of the Exhibition at South Kensington this year is chiefly noticeable for the coming to the front again of the well-known Brush system, says *Engineering*. The lamps erected by the Brush Corporation this year (owing to a very slight alteration in the electrical arrangement) show a great improvement on former lamps, and the slight temporary flicker that was sometimes observable in the old type Brush lamp has now entirely disappeared. The Brush Corporation have their lamps in many of the important divisions of the Exhibition, the whole being maintained by six running Brush dynamos and two spare. These are driven by three separate engines. There are other Brush lamps and dynamos used for lighting the grounds. These are used by Messrs. W. and J. Galloway, and are not under the management of the Anglo-American Brush Electric Light Corporation. The particulars of the machines are: One F 8 Victoria compound dynamo giving 44,000 watts, driven by a Galloway engine in the West Quadrant near the conservatory. One No. 7 L Brush dynamo, driven by Galloway engine, supplying current for 20 Brush arc lamps; 18 on the mast in grounds and two in the West Quadrant over engines.

ELECTRIC LIGHT NEWS

—— The Newton and Watertown Gas Light Company (Mass.) is introducing the electric light. The arc system is to be used.

—— The Wooster, Ohio, Schuyler Electric Light Company, has been organized with a capital stock of $25,000.

—— A system of electric light is contemplated at Cedar Falls, Iowa. S. B. Humbert and F. O. Jackson are interested.

—— The Tremont Electric Lighting Company, Kittery, Me., with a capital stock of $300,000 has been organized. President, William Rotch.

—— The Elizabeth Schuyler Electric Light Co., has just increased its plant by an additional machine, and has taken into its contract the town of Elizabethport.

—— The Mather Electric Co., of Hartford, Conn., have installed a plant of 300 incandescent lamps in the fine building of the *Commercial Gazette*, Cincinnati.

—— The city of Mobile, Ala., have recently obtained from the Brooklyn Electric Construction Company a one hundred and fifty light plant and expect to start the same this week.

—— The Birmingham Gas Light and Illuminating Company, of Birmingham, Ala., is expected to expend $40,000 this season in enlarging and extending its gas and electric light works.

—— The city of Richmond, using the Schuyler system, has appointed a committee for increasing the number of city lights to 300, and to change the number of hours of lighting from six hours to all night.

—— The Carrollton Electric Light, Carrollton, Mo., has been incorporated with a capital stock of $7,000. Charles A. Scott, John S. Wilcoxson, Henry M. Pettit, C. W. Trotter and R. B. Minnis are the incorporators.

—— The Forsaith Electrical Machine Co., Manchester, N. H., has elected the following directors: Samuel N. Bell, Person C. Cheney, Benjamin C. Dean, Stephen N. Bourne, David B Varney, Abraham P. Olzendam, Wm. E. Drew.

—— The Thomson-Houston Electric Light and Heating Company has filed articles of incorporation with the County Clerk at Newark, N. J. The capital stock of the new company is $200,000. The incorporators are Frederick S. Fish, Henry Young and Carroll H. Bassett.

—— Among other contracts which the Schuyler Electric Light Co. has obtained recently are notably, three in Ohio, viz: the Wooster contract for lighting the entire city for three years; Massilon, Ohio, lighting the entire city for three years, with the privilege of ten; and in addition to the city contracts the company has subscriptions for commercial lighting for 60 lights in Wooster, and 100 lights in Canton. The Schuyler Co. has also just completed the installation of 25 additional lights for street lighting for Skowhegan, Me.

—— An electrical crematory is said to have been devised by a process described as follows: The body, being shrouded in sheets made of asbestos, is laid upon a frame composed of fire-brick, while at the head and foot are large copper plates, to which the leads from specially constructed dynamos of large electromotive force are attached. The body apparently occupies the position of the filament in an incandescent lamp, and, upon the current being passed through it, would be instantly carbonized; while, as the air would have free access to it, the process of destruction, or rather decomposition, would be immediate. The process appears to have the recommendation of great rapidity of action, and freedom from many of the objections to cremation in the ordinary way.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JUNE 22, 1886.

344,067 Telephone; Wm. C. Turnbull, Baltimore, Md.

344,072 Chronometer electric call; Wm. L. Barlie and George H. Mills, Baltimore, Md.

344,099 Electric railway signal; Burton H. Gedge, Covington, Ky.

344,100 Electric signal for railroad switches; Burton H. Gedge, Covington, Ky.

344,121 Water-level indicator; Wilbur S. Mayers, Fort Apache, Arizona.

344,153 Telephone; Jules Joas Barrier and Ferdinand Tourvielle de Lavernede, Paris, France.

344,188 Arc lamp; Norman McCarty, Hoosick, N. Y.

344,233 Electric alarm; Carlos M. Barnes, Enosburg, Vt.

344,252 Electric lamp; Joseph R. Dale, Philadelphia, and Wyllis H. Markland, Altoona, assignors to Monroe K. Reeves, Philadelphia, Pa.

344,260 Apparatus for transmitting power from electric motors; Chaimsonovitz P. Elieson, London, England, assignor to the Electric Locomotive and Power Co. (Limited), same place.

344,282 Electric motor; James E. Emley, Weatherford, Texas.

344,318 Induction coil; Francis W. Jones, New York, N. Y.

344,324 Conduit for electric conductors; James F. Munsie, Chicago, Ill., assignor of five-twelfths to Horatio N. May, same place.

344,333 Telephone receiver; Wm. C. Turnbull, Baltimore, Md.

REISSUES.

10,738 Electric arc lamp; Otto Romanze, Tousley Hill, Wandsworth, London, County of Surrey, assignor to Mason, Thornton & Romanze, Wandsworth, London, England.

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National Electric Light Association,

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THE FOURTH MEETING—semi-annual—of the NATIONAL ELECTRIC LIGHT ASSOCIATION will be held at DETROIT, MICH., on Tuesday, 31st day of August, at 10 o'clock, A.M. Dues being payable in advance, all members are required to forward the same for the year 1886, by check or otherwise, payable to the order of J. F. MORRISON, President, Baltimore, Md.

Electric Light Companies and Manufacturers of Electric Light Apparatus, Supplies, &c., desiring to become members, must apply on or before August 31st, to the President, J. F. MORRISON, Baltimore, Md.

Members and others desiring information as to R.R. transportation rates will address J. F. NOONAN, Esq., Chairman Com. on Transportation, Paterson, N. J.

Special Hotel rates will be made known previous to meeting of the Association.

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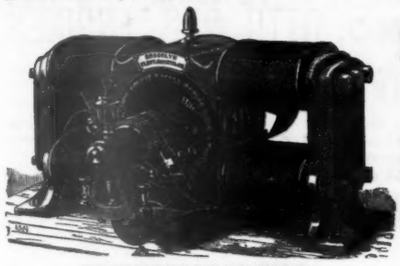

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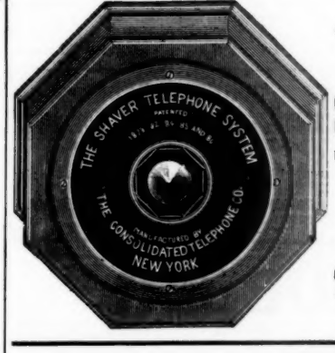

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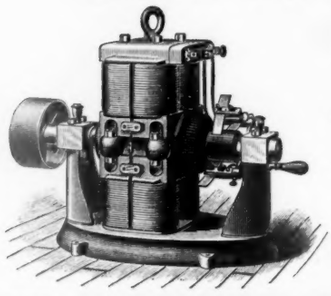

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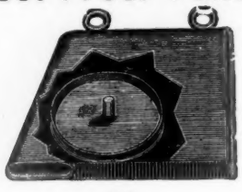

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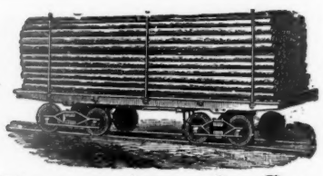

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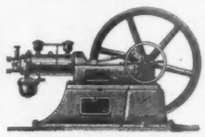

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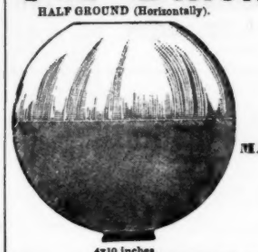

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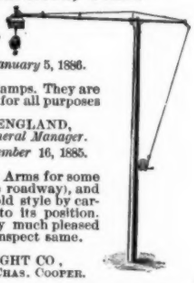

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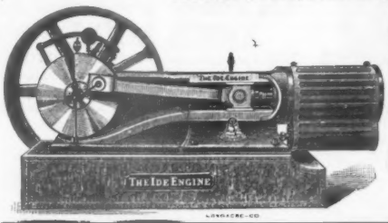

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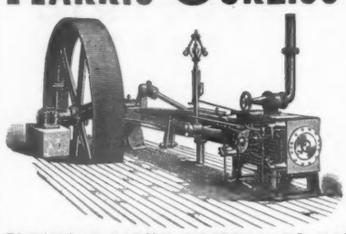

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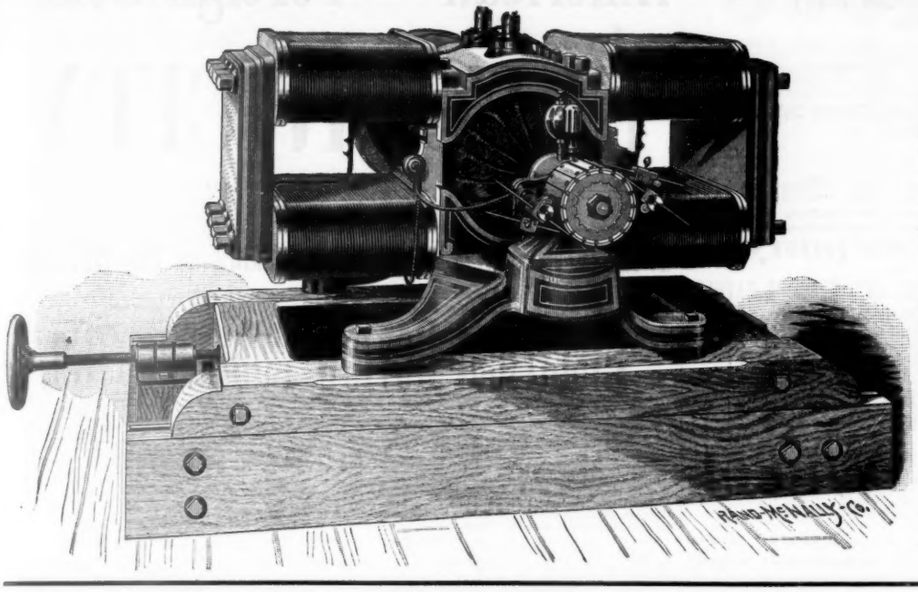

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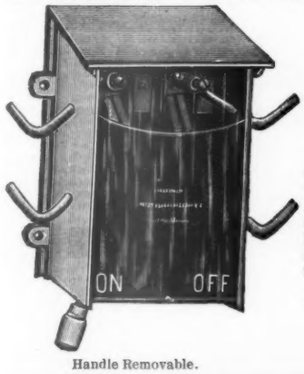

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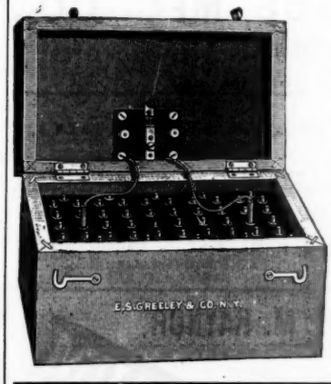

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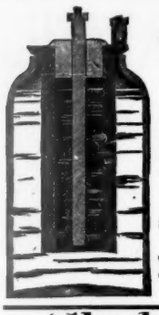

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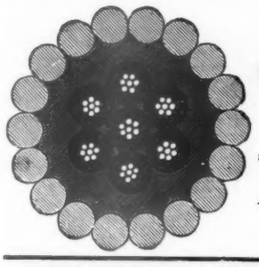

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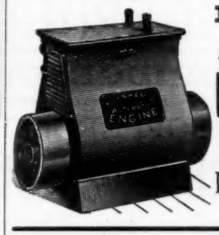

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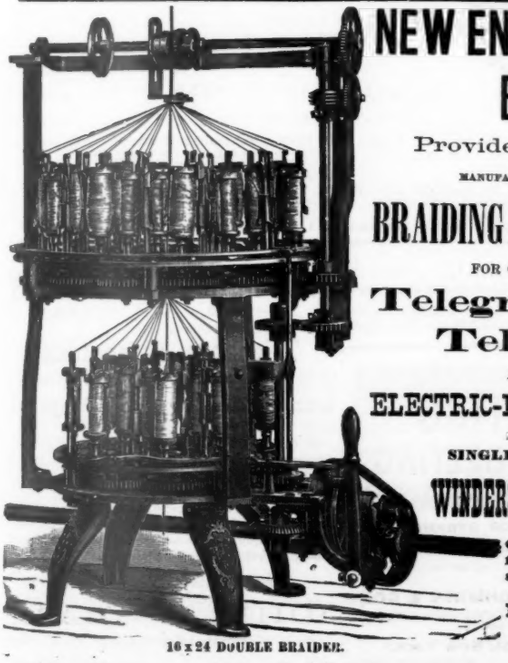

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